March 1965

Agriculture

Vol. 72 No. 3

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SPECIAL WEED CONTROL FEATURE
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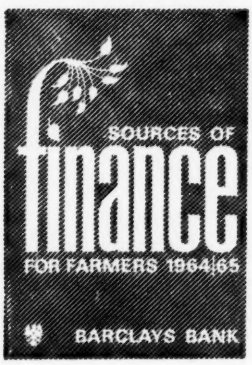

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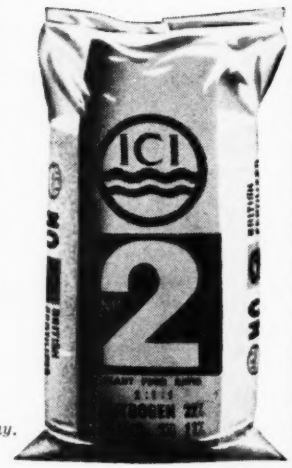

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Agriculture

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Editorial Offices
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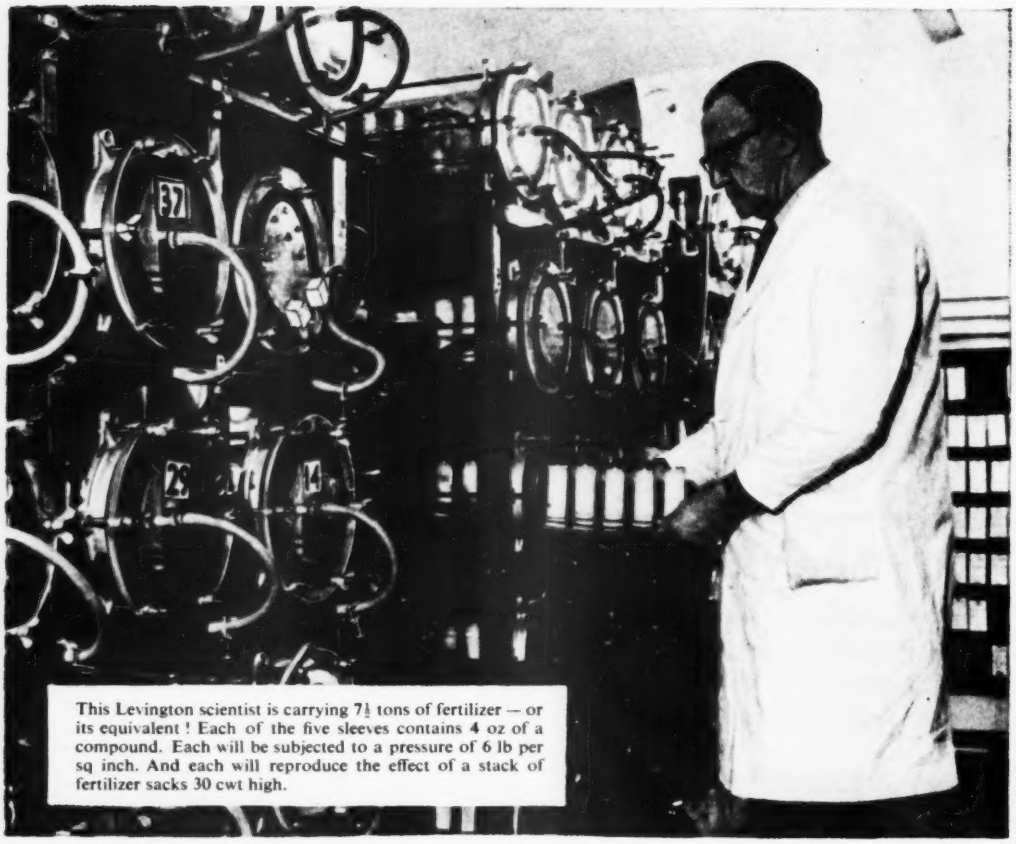


This Levington scientist is carrying 7½ tons of fertilizer — or its equivalent ! Each of the five sleeves contains 4 oz of a compound. Each will be subjected to a pressure of 6 lb per sq inch. And each will reproduce the effect of a stack of fertilizer sacks 30 cwt high.

How **Fisons** stack 4 oz of fertilizer 30 sacks high

One way to test how a fertilizer will store is to store it, leave it—and see what happens. Fisons in fact, do just that before they allow a new compound anywhere near a customer's farm. But to test an experimental formulation which may only be available in small quantities, this method is not practicable. So Fisons have developed a laboratory technique to reproduce the effects of storage on a farm for long periods.

Small batches of the new compound are made in a bench granulator. Then 4-oz samples are placed in elastic sleeves, and 6 lb per sq inch air pressure applied to the outside of the sleeve, which is placed in a glass cylinder. The air inside the sleeve has free access to the atmosphere so that the applied pressure is transmitted from granule to granule as in a sack of fertilizer.

This test reproduces the pressure on the bottom sack in a stack of fertilizer 30 bags high. Throughout the laboratory test, the temperature is kept constant and the humidity controlled.

And this is how Fisons evaluate the results. Each column of compressed fertilizer is placed in an apparatus which measures the pressure needed to break it up. Compounds which need more than 10 lb per sq inch are unlikely to be satisfactory if stored for long periods. Those which need less pressure should store well. The correlation between the results obtained in this test and those obtained under farm storage has been established for a large number of different fertilizer formulations.

This test is only one stage of the screening to which Fisons subject new formulations at Levington Research Station. Compounds which pass are tested again under farm-storage conditions. In bulk stores. In stacked bags. The object of each stage of screening is the same. Fisons make sure that the fertilizers which reach the farmer do their job.

★

Presenting a new feature

This month we have pleasure in introducing the first of our two-colour special features, comprising carefully chosen articles with associated advertising. We thought we could not do better than to take as our opening subject that ubiquitous and supremely important task of weed control, both on arable land and in grass.

We believe it would be a welcome idea to repeat this editorial experiment once a quarter and hope that our readers will derive real practical value from it.

Subjects that we have in mind are the use of electricity, farm buildings and what goes inside them, and an examination of current trends in pig production.

But here our readers can themselves make a really worthwhile contribution by suggesting the kind of subjects they would like to see so treated. We hope you will write and let us know.

The Editor

R. F. Smith

A L S CHELMSFORD

CONSIDERS THE PRO'S AND CON'S OF

Farm buildings as an investment

LONG-TERM improvements are financed either by borrowing or by liquid capital which, if invested elsewhere, would earn interest. It seems reasonable, therefore, that an improvement should be charged with a similar rate of interest and this, for the sake of simplicity, could be the prevailing interest charged by the Agricultural Mortgage Corporation. It might be argued that if the cash available were used to bolster working capital—more livestock, new machinery and so forth—it would produce a higher interest. This may be true in a number of cases and it should be considered before investing the money in fixed equipment. Another factor is the recoupment of the capital sum invested, except in those cases where the improvement is likely to last for an indefinite period—in valuation parlance 'in perpetuity'. Most farmers, either wittingly or otherwise, consider this; they may call it depreciation, amortization or a sinking fund, but in theory it amounts to the setting aside of an annual sum, the accumulation of which will replace the original capital over a predetermined period.

The cost of maintenance, insurance and management may increase following improvements, but this should not be significant unless the expenditure is fairly heavy. It is all too apparent that the repair of old buildings is becoming an increasing burden, due to the high level of wages and cost of materials and also the difficulty in persuading builders to tackle this sort of work. Great progress has been made over the last ten years or so in the use of low-cost maintenance materials for farm buildings such as reinforced concrete and asbestos cement sheeting. Most farmers will think very carefully before letting a bulldozer loose on a set of buildings, but if on reflection it is decided that the maintenance liability in the future is going to be really high, then let the bulldozer get to work! The relative merits of permanent buildings constructed of maintenance-free materials as against low-cost temporary buildings should be considered in relation to the needs of the farm, both immediate and long-term.

Economic life of buildings

On many farms we still see buildings of 'battleship' construction, erected a century or more ago and which will stand for a good many years yet, but the problem is to make these outmoded buildings meet modern farming requirements. Often they are in the wrong position or too small or laid out in a way that was satisfactory when labour was a few shillings a week but not now at upwards of £750 a year. In some cases it may be possible to make adaptations, such as the provision of a waterproof concrete floor for storage of grain in a tithe barn, but there must be many cases where the physical life of the structure will exceed its usefulness on the farm. So when contemplating new equipment a little thought might usefully be given to the period over which the building is likely to serve the farm without major expenditure on adaptation. This period must vary considerably, and to some extent we tend to gaze into a crystal ball or at best rely on informed opinion.

Rapid changes in farming techniques imply that specialized forms of fixed equipment may become obsolete in design after a fairly short period, and it is therefore necessary to write off value accordingly—the period depending on the degree of specialization. The economic life of a general-purpose building might be taken as about twenty years due to its flexibility of use, whereas a specialized piggery or calfhouse might have a life of only five years. A great deal has been said and written about the general-purpose building, and while flexibility is undoubtedly desirable, it is important to avoid spending more on adaptation than a specialized building would cost.

Tax allowances

The allowances which may be set against earned income in respect of capital expenditure on agricultural buildings and works are fairly well known, but it may be helpful to restate them briefly as a ready reference. Firstly, there is the Investment Allowance of 15 per cent of the net capital sum after deduction of grant-aid (it used to be 10 per cent until changed by the Finance Act 1963). Secondly, under the Capital Expenditure Claim, 10 per cent of the net cost may be deducted from taxable income for each of the succeeding ten years. Eligible items include capital spent on construction or improvements of farmhouses, cottages, buildings, roads and most other works of a capital nature. In the case of farmhouses the allowance is restricted to one-third of the cost.

When considering the worthwhileness of any investment in fixed equipment, tax concessions clearly cannot be ignored; the greater the tax liability, the more these concessions become important. Indeed, the point may be reached where, with tax at 17*s.* 6*d.* in the £, the tax refund over ten years is not far short of the amount originally spent on the improvement, but it would be unwise to justify any improvement on this ground alone; if income (and therefore the level of tax) falls, or if the basis of tax relief is altered, the calculations will have gone somewhat astray.

Do new buildings enhance freehold values?

It is known that the replacement value of fixed equipment on many farms will fall not far short of the open market value of the farm and, with the intensification of farming which we see today, the investment in buildings may well exceed the value of the land. There is no doubt that the intrinsic value of a

farm is in the profit-earning capacity of the land. Any profit which may come from the buildings is incidental in the majority of cases.

There seems no reason to suppose that freehold prices will not continue to rise, and the increase will not necessarily be enhanced by expenditure on fixed equipment. For the farmer seeking a moral in all this it seems important to justify the capital investment in relation to the benefits to be derived during the life of the improvement rather than look for recoupment on sale.

More land or more buildings?

Whether to buy more land or to put the money into buildings with a profit-earning potential is a question on which there is a great divergence of opinion. Farmers may not necessarily look at investment in land as a growth stock, but nevertheless that is what it is. Land coming on to the market is somewhat limited and dreams of expansion may sometimes take years to materialize. Building work, on the other hand, can be undertaken at any time and income can commence within a fairly short period. It seems that a chance to buy more land should not be lightly turned down, even if it is necessary to borrow a high proportion of the purchase price, but if farming on the present acreage is hampered by obsolete buildings it may be better to use capital (if necessary borrowed) to replace them. There is a difference between buildings, such as cattle yards, which are needed for the proper farming of the land and piggeries which may serve non-land-using enterprises.

A new idea seems to be developing whereby fixed equipment such as grain silos is supplied by means of a leasing agreement, the farmer being charged rent based on a percentage of the capital cost with an option to purchase at the end of the lease (normally for a maximum of five years). This scheme may appeal to the farmer with limited capital resources, particularly an annual tenant. However, the economics of leasing *vis-à-vis* outright purchase need to be carefully studied—and obviously the financial circumstances of the individual farmer will greatly influence the decision, particularly his liability for income tax.

Less labour costs

Let us now turn to the important question of justifying expenditure on fixed equipment. It has been said that it is easier to justify expenditure on saving labour than on increasing production. An improvement which has for its *raison d'être* a significant saving in labour costs—remember half a man is neither physically possible nor economically sound—is likely to become more worth while in the future than one based on greater production, because the cost of labour is likely to increase more than the price of produce. Labour utilization usually involves work study, and it is only by carrying out a critical examination of all activities in and around a building that the full potential of the fixed capital can be exploited.

Better prices

Despite earlier remarks, to maintain quality capital expenditure may be necessary to enable produce to be stored and handled in a satisfactory condition—insulation, ventilation, moisture control and so forth. These requirements may be met by permanent buildings of specialized construction, as in the case of cold stores for fruit or a cheaper type of improvization such as a Dutch barn with straw bale walls for potato storage. A standard quality

is required for many products, and this clamour for quality will increase the need for improved storage and handling facilities.

Greater output

In many cases new buildings are needed to increase the output from the farm in order to improve the net profit. This can either take the form of extending an existing enterprise (for instance, increasing the size of a dairy herd) or of introducing an entirely new enterprise such as a pig unit.

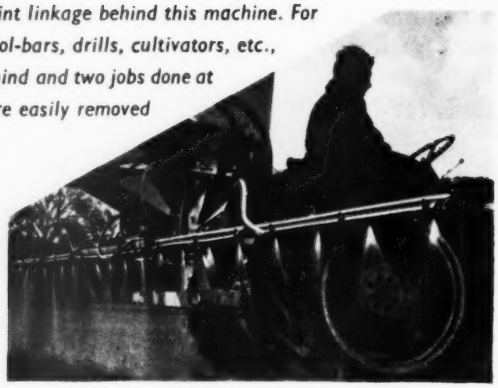
Better working conditions

Good labour surely deserves good working conditions. It is becoming increasingly important to provide shelter and warmth in winter for such jobs as machinery maintenance, potato riddling and parlour milking. Insulation of industrial buildings in which people work is now a statutory requirement and some farmers have deemed it well worth while to follow suit; adequate lighting, both natural and artificial, and a clean atmosphere also deserve thought. Expenditure which will remove some of the drudgery from farm work must claim consideration. Why not design a feeding manger so that cattle can be fed from a trailer instead of humping sacks around? The need for housing improvements are generally appreciated by farmers, but there must still be many thousands of sub-standard cottages up and down the country which lack the amenities taken for granted these days. This expenditure cannot be justified on purely economic grounds (the immediate monetary return is often negligible) but if the result is a contented worker (and, just as important, his wife and family), surely this is worth while.

Profit-earning capacity of long-term improvements

A variety of factors may give rise to the need for spending money on fixed equipment, and in some cases it arises from a critical examination of the various enterprises on the farm which may indicate that a change in farming policy is desirable. An entirely new line of production may be contemplated such as a pig fattening unit on an arable farm where there is little change on the farm as a whole. With these thoughts in mind, consider a hypothetical scheme involving the provision of a bacon house for 200 costing £2,400 after deduction of grant. The interest on capital will be 8 per cent (to allow for the increase in borrowing rates) with a sinking fund over ten years, having regard to the specialized type of building, giving a rent charge of about £400 per year. There is a strong school of thought that the period for writing down such a building should be only five years, in which case the rent charge would be increased proportionately. Assuming purchased weaners go into the house at 8 weeks old, giving an annual throughput of 400 pigs, and if the profit before charging interest on buildings is 45*s.* per pig (£900 per year), the net profit on the enterprise would be £500, which would need to be related to the working capital employed in terms of average value of pigs, food, labour and miscellaneous expenses.

There are still many farms on which capital can usefully be invested in farm buildings, and the incentives in the form of grants and income tax concessions make such schemes all the more attractive. But it is advisable to go into the matter in some detail to find out what benefits are likely to be derived and whether they are in line with the costs.



There is a three-point linkage behind this machine. For placement work, tool-bars, drills, cultivators, etc., can be mounted behind and two jobs done at once. The booms are easily removed

FERTILIZERS:

SOLID OR LIQUID?

J. D. Thirkell

puts the case for

Fertilizers in Solution

AMONG the claims made for the use of concentrated liquid fertilizers is that they are cheap and efficient to apply, ideal for bulk handling and economical of labour. The idea of liquid fertilizer is not new, but some of the manufacturing and application techniques which have made the sudden growth of this industry possible are. Current liquid fertilizer practice tends to differ markedly from opinions formed after experience with gas liquor.

The raw materials used in liquid fertilizers fall within the same range as those used in solid fertilizers, but high-grade sources have to be used to produce really clean solutions. Concentration is obviously limited by solubility, so that liquids tend to be less concentrated than high-analysis solid fertilizers. A typical liquid fertilizer percentage analysis is 14 N, 6 P_2O_5, 8 K_2O.

Delivery to farms

Currently there are five liquid fertilizer plants in England and one in Scotland. Several more are on the drawing board. Fertilizer is hauled in bulk (14–20 ton loads) from the manufacturing point to suitably situated distribution stations which act as buffer storage. From these stations fertilizer is delivered to the farm in 7–10 ton tankers.

Where liquid fertilizer business is well established the distribution station may become unnecessary, and indeed an appreciable tonnage is now being delivered direct to farms from the manufacturing plant.

Because of the inherent physical properties of liquids, and flexibility in changing from one formulation to another, liquid fertilizer plants have an

extremely high production and dispatch rate. This helps considerably to meet seasonal peak demand. But with tonnages increasing at the rate of 50 per cent per year, it is necessary to encourage a lengthening of the period over which fertilizer is dispatched from the plants. Substantial rebates for early delivery into farm storage help to achieve this; they not only pay for the tanks, but leave a margin for the farmer.

Storage on farms

Farm delivery is normally made into some kind of mobile storage tank (4–10 tons capacity) out in the fields where the fertilizer is to be applied, either by the farmer or by contractor. If delivery is made into a centrally-situated bulk storage tank the fertilizer can be taken to the field either in a high capacity applicator or in inexpensive tanks mounted on farm trailers.

The field delivery system entails one handling only (tank-applicator) by the farmer, and if the tank is hired from the distributor the farmer has an excellent bulk handling system with no capital requirements. The National Institute of Agricultural Engineering is carrying out a survey of this type of bulk handling system and comparing it with conventional methods.

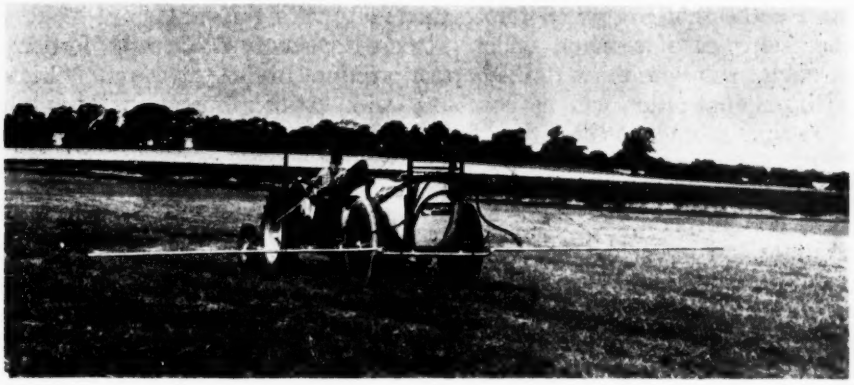
The bulk storage delivery system requires an extra handling (from store to field), but this is justified by the rebates available. The bulk storage tank itself can be sited centrally, is relatively cheap per ton of storage capacity, and it minimizes access problems because of flexible pipe delivery.

The rate of handling liquid fertilizer is not dependent on the activity of men, but on the capacity of a pump—1–7 minutes per ton, according to the pump.

Application

Liquid fertilizers can be broadcast or injected (placed) on contract, with hired equipment or with farmer-owned equipment. To help establish liquid fertilizer application techniques and to bridge the gap between their introduction and the justification of farmer-owned or hired equipment, a complete contracting service is available. Where it fits in with the farm economy a contract service is available on a long-term basis. Because of the bulk handling attributes already mentioned, liquid fertilizers lend themselves to efficient contract applications.

Trailed sprayer application gives a high rate of working. The sprayer in use here is capable of applying anything between 1½ and 20 cwt per acre of liquid fertilizer



A 100-gallon capacity liquid fertilizer/weed-killer/pesticide sprayer

It might be said, however, that some application techniques do not lend themselves to contract work, and this underlines the importance of farmer applications with owned or hired equipment.

Liquid fertilizer application equipment is multi-purpose, combining fertilizer distributor, weed-killer/fungicide/insecticide sprayer and a variety of placement attachments all in one machine, thus economizing considerably in farm machinery capital, giving savings of 15–20 per cent.

Liquid fertilizer is sprayed at low pressures through large orifice jets, giving a large droplet size. This gives very even and accurate applications, whilst reducing the risk of scorch. The evenness comes from the spray pattern, the accuracy from using a homogeneous material unaffected by weather, and these two attributes can be combined with speed because they are unaffected by the width of the boom. This leads to normal working rates of 10–16 acres per hour, including handling, or considerably more where wide booms are used.

There is no doubt that injection, by placing materials in the soil within easy reach of plant roots, has considerable advantages. The reason for its restricted use with conventional fertilizers lies in the complexity of the necessary machines and their slow rate of working.

Liquid fertilizers make it possible to combine fertilizer placement with other husbandry operations, without actually interfering with the efficiency of the particular machine being used. Mechanical complexity is avoided by carrying the fertilizer in a tank mounted on the tractor away from the machine being used (e.g., potato planter) and taking advantage of the flow characteristics of a liquid under pressure to simply deliver the fertilizer through small bore tubes to the correct position. In this way a very efficient fertilizer application can be combined with another operation. The only extra time taken is in the filling; fertilizer handling for this is minimized for liquids anyway.

In this way, injection can be combined with potato planting, sugar beet drilling, transplanting, cereal drilling, rowcrop hoeing and seedbed cultivations.

A great deal of trial work has been carried out at the Experimental Husbandry Farms, comparing liquid and solid fertilizers. If it is possible to draw any conclusions before all the trials are complete, it is that, applied under the same conditions, liquids and solids give comparable results. This

is a reasonable conclusion, since virtually the same raw materials are used in the manufacture of both. This, of course, raises the question whether liquids can be handled and applied more efficiently than solids.

Aqueous ammonia

The establishment of injection techniques on the farm paves the way to the use of aqueous ammonia as a nitrogen source. Aqueous ammonia is a solution of ammonia in water, normally being used as a fertilizer at a concentration of 25–28 per cent N, and it has to be injected. Since virtually all other nitrogen fertilizers are made from it, it has and will continue to have, a considerable price advantage. Thus once the techniques outlined above have been adopted, use will grow rapidly, since it can be handled through normal liquid fertilizer equipment.

Because of their physical properties, liquid fertilizers make ideal carriers for other agricultural chemicals, particularly where it is necessary to make small quantities cover a large area. The most obvious examples are weed-killers and herbicides, with nematicides, insecticides and trace elements as possible inclusions, but persistent pesticides should not be applied in this way as a routine.

Chief Veterinary Officer

Sir John Ritchie, C.B., who has been Chief Veterinary Officer of the Ministry since 1952, is retiring from Government service on 2nd April. Sir John has been appointed by the Council of the Royal Veterinary College to be Principal and Dean of the College in succession to Dr. R. E. Glover, who will retire on 30th September, 1965.

Mr. John Reid, M.R.C.V.S., becomes Chief Veterinary Officer.

G. R. EARP

Blackcurrant Reversion

The symptoms to look for

A virus disease which is spread in two ways: by propagation of infected material, and from bush to bush by Big Bud Mite. It is not known to be transmitted naturally by any other means

RESEARCH workers have been examining the problem of blackcurrant reversion and its control since 1912, but to date in fruiting plantations, no method of complete control has been achieved. The situation relating to propagation material, and the demand for a stock known to be free of both reversion and Big Bud Mite, is likely to be resolved in the near future. However, we must still depend upon reducing the spread of the virus in plantations by removing bushes showing symptoms of infection and by control of blackcurrant gall mite (Big Bud Mite) by sprays. This pre-supposes that we recognize reversion when we see it.

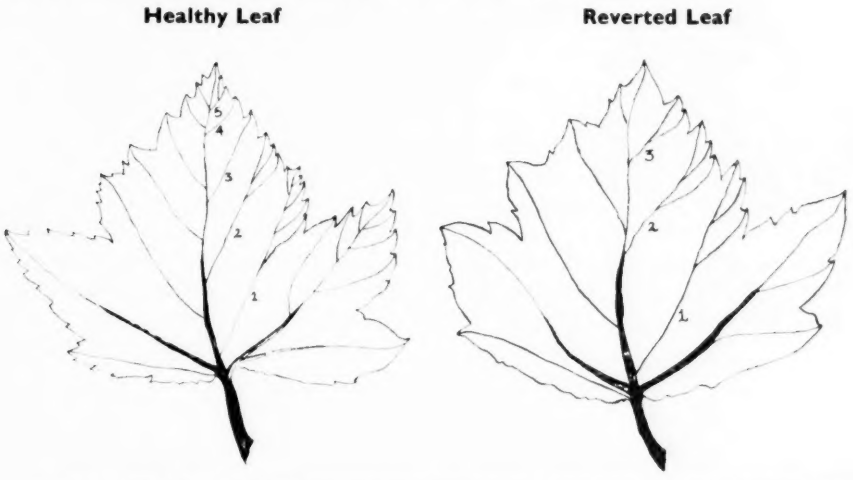
The symptoms can be seen at two main periods of the year—flower-bud and summer-leaf stages. The presence of big buds in the dormant season indicates a severe infestation of gall mites, and in many cases this can be regarded as symptomatic of the probable presence of reversion virus in the stock, although it is possible under some conditions for reversion to be present without Big Bud symptoms being apparent. These two stages frequently occur independently, particularly during the early stages of reversion infection symptoms.

Flower-bud stage

The earliest symptoms of reversion can be seen at the beginning of each growing season, between the time when miniature flower buds can be seen at the base of the developing spur leaves and the first open flower stage. The length of time when these symptoms are apparent varies with the season, but it can be fourteen to eighteen days. The earlier the observation is made the better. Healthy flower buds have a dark purplish colour, covered with a down of fine white hairs, giving the general impression of grey. Flower buds on infected shoots have very few short hairs, and the actual bud colour is a rusty brown. One or more flower trusses on a bush may show symptoms of reversion; on severely infected bushes all trusses will show these symptoms.

Summer-leaf symptoms

The summer-leaf symptoms of reversion are evident by the general flattening of the leaf. This is caused by the reduction of the basal sinus and the change in structure of the leaf where the veins and number of serrations in and around the central leaf lobe are reduced. A healthy leaf has five or more main veins on each side of the main lobe, whereas on a reverted shoot the leaves have four or less on each side. The total number of serrations on each side of the main lobe, whether they form the terminal point of a main or secondary vein or not, is at least thirteen; on a reverted leaf there are twelve or less. The reduction in veins and the number of serrations become progressively less as the intensity of the infection increases.



When checking for leaf symptoms on more than one variety in a plantation, it is wise to take extra care if one of them happens to be Westwick Choice. The natural shape of healthy leaves of this variety can look at first very similar to reverted leaves of other varieties.

The best time for observing leaf symptoms is mid-June—mid-July, but according to the severity of the infection, symptoms may be visible for much of the season. Bushes carrying an established infection can often show paler than normal leaves from the late bud-burst stage until the mid-flowering stage; also these bushes showing severe infection symptoms can be identified by the typical leaf characters from the early 'grape' stage onwards.

A study carried out for the past three years in Suffolk has shown the need for roguing plantations at three stages of bush growth each year to be sure that the maximum number of reverted bushes are identified. Assessing the use of single stage expressions of infection has shown the superiority of leaf symptom identification over both flower and Big Bud stages, but the leaf symptom observations are not efficient enough because of the practical difficulties in carrying them out. During the course of this work several factors were recorded which have a bearing on the efficiency of roguing for reversion.

Big Bud Mite

The connection between Big Bud Mite and reversion has long been established, but the pattern of the visual relationship does not appear

G. R. EARP

Blackcurrant Reversion

The symptoms to look for

A virus disease which is spread in two ways: by propagation of infected material, and from bush to bush by Big Bud Mite. It is not known to be transmitted naturally by any other means

RESEARCH workers have been examining the problem of blackcurrant reversion and its control since 1912, but to date in fruiting plantations, no method of complete control has been achieved. The situation relating to propagation material, and the demand for a stock known to be free of both reversion and Big Bud Mite, is likely to be resolved in the near future. However, we must still depend upon reducing the spread of the virus in plantations by removing bushes showing symptoms of infection and by control of blackcurrant gall mite (Big Bud Mite) by sprays. This pre-supposes that we recognize reversion when we see it.

The symptoms can be seen at two main periods of the year—flower-bud and summer-leaf stages. The presence of big buds in the dormant season indicates a severe infestation of gall mites, and in many cases this can be regarded as symptomatic of the probable presence of reversion virus in the stock, although it is possible under some conditions for reversion to be present without Big Bud symptoms being apparent. These two stages frequently occur independently, particularly during the early stages of reversion infection symptoms.

Flower-bud stage

The earliest symptoms of reversion can be seen at the beginning of each growing season, between the time when miniature flower buds can be seen at the base of the developing spur leaves and the first open flower stage. The length of time when these symptoms are apparent varies with the season, but it can be fourteen to eighteen days. The earlier the observation is made the better. Healthy flower buds have a dark purplish colour, covered with a down of fine white hairs, giving the general impression of grey. Flower buds on infected shoots have very few short hairs, and the actual bud colour is a rusty brown. One or more flower trusses on a bush may show symptoms of reversion; on severely infected bushes all trusses will show these symptoms.

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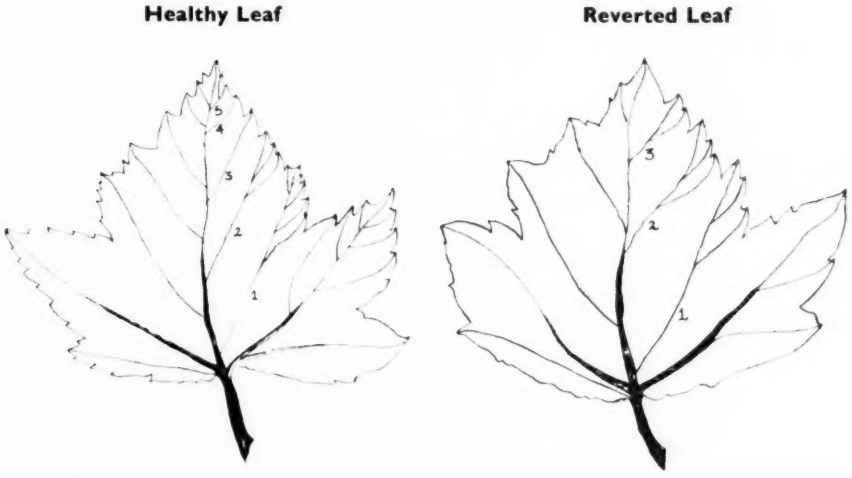

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Big Bud Mite

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In the early stages of infection the reductions in the numbers of veins and leaf-edge serrations are not necessarily apparent at one and the same time. Although taken from an infected bush, all these leaves have full vein complements

to be standard. The important point is the visual implication of mite infestation; not all the buds infested by mites swell to the typical 'Big Bud' size, so that whereas it would be safe to assume that bushes showing Big Bud Mite infestation will sooner or later show reversion symptoms, not all apparently normal buds are free of mites inside them. Infested buds are not necessarily swollen until late in the dormant season.

The buds may become abnormally swollen because of 'natural' occurrences, such as decapitation of strong growing shoots during the growing season, and young vigorous bushes may carry similar buds. To the untrained eye, all of these buds can confuse identification. Some buds become enlarged through the fasciated formation of the bud tissues, irrespective of any malformation of the shoot on which they are produced. Identification is fairly easy by close examination of these buds, but in a plantation with mite-infested buds as well, confusion can occur.

In a plantation of Westwick Choice used during the Suffolk work it was noted that although being adjacent to a plot of Wellington XXX showing moderate signs of both reversion and Big Bud Mite infestation, little carry over occurred into the Westwick Choice. This would seem to confirm the observation made earlier that the French Group seemed to be resistant to Big Bud Mite attack, especially as Westwick Choice is partly derived from French. This is certainly not true of all plantations of Westwick Choice, but it may be associated with certain conditions.

Flower symptoms

Although much easier than leaf symptoms to observe in the early stages of infection, flower symptoms have not been shown during the Suffolk

study to be good enough to identify the first symptoms of reversion. Nevertheless in conjunction with the other symptoms of infection, this method can be valuable in determining the maximum number of bushes infected. With large bushes, the flower check gives a much greater chance of success in observing the whole bush; there is little impediment by the leaves at this early stage.

After rain, when mechanically bruised, or when the trusses have been frosted, identification becomes more difficult, but under these conditions the number and the position of trusses will give a fair indication of the cause of the discoloration.

Leaf symptoms still the best guide

Diagnosis by leaf symptoms has been the standard method accepted for identifying reversion in the field and according to the results of the recent work this principle has been confirmed. The drawback is in the practice of this job; unless roguing on leaf symptoms is done by an experienced person, only a small percentage of bushes showing partial infection will be noted. But however inexperienced the worker, bushes showing all branches affected can be picked out with little trouble.

Work being carried out at the present time at East Malling has shown that early infection symptoms are vein clearing or a banding effect around the leaf veins in the affected areas. These symptoms appear rather difficult to observe in the field during routine roguing inspections.

During the course of three years intensive observations, no new symptoms of reversion virus infection capable of use in the commercial field have been recorded, but the value of indentification by single symptom expression has been evaluated to:

70 per cent of all bushes showing new symptoms did so at the leaf stage, in the absence of previous flower symptoms or Big Buds.

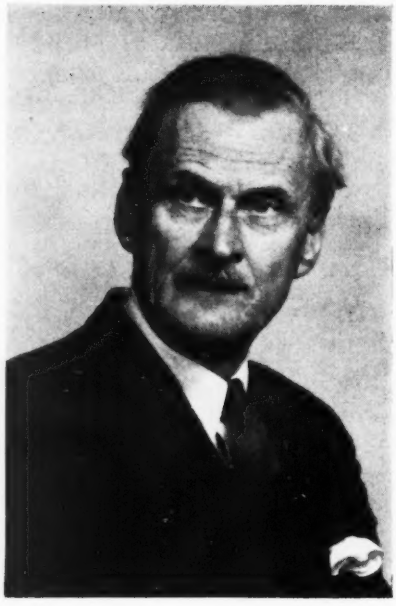
16 per cent showed first symptoms at the flower stage. 14 per cent showed first symptoms recorded at the Big Bud stage.

The whole problem of identifying blackcurrant reversion virus infection is complex because it is not always possible to record all manifestations by visual inspection, mainly because it is not humanly possible. Even if inspections were carried out by persons of extreme capabilities, reversion would still occur in plantations because symptoms of infection do not always follow immediately after the infection has occurred. Indeed a long time may elapse before recognizable symptoms appear. It is fair to say that anyone should be able to identify bushes severely affected by reversion, but difficulties can occur in observing the *early* symptoms of the trouble.

If the trend towards closer planting of fruiting bushes continues, it may become even more important to maintain scrupulously clean propagation material. Also, the general reduction in profit margins of all crops makes it important to produce as high a yield as possible from the maximum number of bushes.

G. R. Earp, N.D.H. (Hons.), had 6 years horticultural experience in the Midlands before joining the National Agricultural Advisory Service in 1958. He was at the Ministry's Stockbridge House Experimental Horticulture Station, in Yorkshire, before taking up his present appointment as Horticultural Advisory Officer in Suffolk.

The pattern of soil distribution in Britain is extremely complicated; widely differing soils may often lie side by side. This may affect not only their drainage requirements but their behaviour under irrigation as well. What is sufficient for one may create a surplus in another, especially bearing in mind the capacity of water to travel from one place to another below ground



Basil Furneaux

discusses

Wet Soil

seen and unseen

WE are inclined to take our soil for granted—until something untoward appears at the surface. Seldom do we think of draining land until we see water lying about on it, or we find that it is becoming difficult to handle, yet there are large areas of land that walk reasonably dry, even in wet weather, which nevertheless are in trouble deeper down and would benefit considerably from draining. On the other hand, draining is by no means the cure for all wet land; very often soils that allow water to percolate freely from their subsoil layers, are so badly capped at the surface, or panned by cultivation a few inches below it, that water has the greatest difficulty in soaking into the ground. In the latter case, the remedy may well lie in a change in the cultural methods rather than in laying a system of drains.

Of course, the problem becomes compelling once the land starts getting difficult to cultivate or stock. But we must not lose sight of the fact that a good deal more than half of any pasture, or arable crop, is out of sight, underground, and it is the conditions under which that part is living to which we must give thought when we consider draining the land. Roots are

difficult things to study because of their inaccessibility, and for that reason we tend to attach less importance to their health and well-being than we do to the parts that we can see. If the leaves start to look unhealthy and die, we soon become worried and commence to do something about it, but if the same thing happens to the roots, we are usually unaware of it and we do nothing so long as the crop still looks all right.

Roots need air

The first point to realize is that most plant roots explore far more deeply than most people suppose; they go right through the soil and penetrate well into the weathering geological material that lies beneath it. It is very seldom that I find a pasture that has failed to send its roots down 30 inches, while under favourable conditions grasses and cereals can easily penetrate to more than six feet, and root crops still further. The important point, however, is that these roots must be able to breathe, right to their extremities, if they are to operate effectively or indeed survive.

The particles of almost all soils are in reality very loosely packed, so that they contain a huge number of small spaces among them. The particles themselves are surrounded with a film of water, upon which the roots depend for their supplies, while the larger spaces are filled with air which enables them and the other organisms in the soil to breathe. After heavy rain most of these spaces become filled with water, which drives the air out of them. Soon the activity of the roots and of many of the beneficial creatures is brought to a standstill and cannot be resumed until conditions for respiration are re-established by the surplus water soaking away, so allowing these cavities to fill with air once more.

In free-draining soils this may occur quite quickly, but in those which lie upon relatively impervious material, such as stiff clays, it may take a long time—so long that many of the deeper roots may be damaged, or even killed.

Examine the soil first

There is no rule of thumb about draining. There are a number of factors that lead to bad drainage, while the soils affected by it vary immensely in character and show great differences in their anatomy. Before starting any draining operations, it is always essential to examine the land closely first, to ascertain the nature of the soil (in any field there may well be more than one) and the reasons for its poor drainage. The object of this is to be able to lay the pipes as deeply as conditions will permit, so making available to the roots the largest possible volume of soil, and also to be able to form some idea of the permeability of the subsoil, as a guide to the correct spacing of the drains. The closer together the drains are laid, the more effective they will be; also the more expensive. How far apart to put them can be determined only by examining the material through which the water will have to flow.

Although the commonest cause of bad drainage is the impervious nature of the underlying geological material, in some districts small springs are common, and these have the added nuisance that the water continues to well out of the ground long after the rain has ceased, with the result that the wet patches caused by them seldom, if ever, dry up. The soil of the flat

Water, water everywhere! But it may not be the drains that are at fault

land beside streams and along the coast may often be beautifully porous, but it lies wet purely because the gradients are not sufficient to get the water away without the help of dykes with pipes leading into them. Nowadays much of this kind of land can be made first-class at no great expense by pumping.

But accurate diagnosis of bad drainage is essential; to rely upon *visible* wetness of the ground can be very misleading. A freely-draining soil is usually even coloured, whereas one that is badly drained will be seen, on close inspection, to be mottled, or stained with rusty iron deposits. The intensity of these symptoms and the depth at which they appear, provide the necessary evidence.

Depth and spacing

It is almost always possible to make the ground porous to a depth of 30 inches by growing a vigorous and well-managed pasture or ley upon it; therefore that can usually be taken as the minimum depth at which drains should be laid, even though the soil itself may be very much shallower. With the help of the drains, the grass roots will steadily break up the subsoil —though this may take some years. The use of an adequate fertilizer programme will be vital during this period in promoting vigorous activity of the roots.

Many soils, however, are much deeper than 30 inches and it is folly to drain only the upper part of them, especially the deep alluvial ones beside rivers which frequently become much more porous in their lower layers. In these the pipes should be laid at least 48 inches deep. Here the water can flow with far greater ease than it can in the heavier and more compact layer that occurs at 30 inches.

On sloping land, where through the years soil has washed off the higher parts and accumulated in the lower, it may well be that the pipes should be laid at 30 inches in the high land and gradually set deeper as the lower part

of the field is reached. Certainly, wherever possible the drains should be laid at the bottom of the soil, so as to make the whole of it available to roots. Paradoxically enough, draining land will make it less liable to suffer from the effects of drought. This is because the crops can develop a deep root system and are thus able to draw upon a greater volume of soil.

Spacing the drains inevitably involves compromise, because economic considerations demand that they should be as widely apart as will allow them to be effective. Some crops will tolerate longer periods of saturation at their roots than others. Perennial plants are more exacting than annuals, because the former must be protected against the conditions that will arise during the wettest season likely to occur. Thus a standard of drainage that would be perfectly adequate for a crop of corn might well fail to protect a field of gooseberry bushes or dessert apple trees. On heavy land it is common practice nowadays to lay the drains one chain apart, but on the shallower soils whose capacity to absorb water is limited, closer spacings, such as were commonly used years ago, may be called for. On the porous alluvial soils, on the other hand, where it is possible to lay the pipes at a depth of four feet or more, two, or even three chains apart will in many places be adequate.

Wherever possible the pipes should cut across the direction of flow of water, so as to intercept it in its progress. Thus on sloping land they should cross the gradient and, where they empty into main drains, the latter should run down the maximum slope to get a rapid flow which will prevent silting. This is always likely to happen where the speed is checked.

Irrigation

The rapid increase in the practice of irrigation must inevitably lead to a critical re-examination of the drainage characteristics of much land upon which it is carried out. When a grower has just completed the application of a couple of inches of water, nature may add an unexpected contribution almost immediately afterwards! Many crops that are capable of tolerating a breakdown of respiration at the roots during the dormant season can put up with only a much shorter interruption when in active growth. Efficient aeration of the soil at that time therefore assumes an added importance. Without irrigation, the deficit that builds up during a normal summer is not entirely eliminated until well into the winter, but where it is practised there will be a surplus to be disposed of much earlier, so the ground may remain waterlogged for much longer periods.

Good soil structure

One important point that should never be overlooked is the structure of the soil. Even where pipes are placed very close together, much of the water must have a long way to travel before it can reach one of them. This it does through the complex network of channels and crevices which permeate the soil and which collectively make up its structure. Under good conditions the drains will work efficiently, but if the same soil is panned and if its crumb structure is allowed to deteriorate through shortage of organic matter, water may have difficulty in travelling through it, and may even lie on the surface. For the same reason a soil that is inherently freely-draining may give the appearance of needing drainage.

Thus the efficiency of a system of land drains always depends upon two distinct factors: first, that its design and layout should be appropriate to the soil and situation, and second, the structure of the soil should be sufficiently well developed to enable it to work properly. Its whole object is to admit air to the ground.

Basil S. Furneaux, M.Sc. (Agric.), Dip. Agric., was a member of the research and advisory staff of Wye College until shortly after the outbreak of war, when he was seconded to the Rural Land Utilisation branch of the Ministry of Agriculture. After the war he set up in private practice as a soil surveyor and consultant and, besides advising farmers, especially fruit and hop growers, on the quality of land and problems of soil management, he does a lot of work in connection with town and country planning. Essentially a field surveyor and not a laboratory worker, he is a Governor of Wye College and of the East Malling Research Station.

Research Spot

The N.I.A.E. reports

The three main functions of the N.I.A.E., which is one of the grant-aided research stations of the Agricultural Research Council, are research, development and testing in the fields of agricultural and horticultural engineering. A very broad spectrum of activity is therefore represented. It embraces the research worker pursuing an abstruse problem in the laboratory and the engineer evaluating the most modern machinery or technique in the field

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THE diverse nature of the work of the National Institute of Agricultural Engineering can be seen from the cross-section of projects reviewed here. Some results, such as reports on machinery tests, can have direct and immediate application, whereas other results may depend on longer term research.

The orchard, the picker and the machine

The damage caused by machine picking is always likely to be beyond an acceptable level, and the hand picker is not therefore likely to be replaced by the machine except when fruit is harvested for processing. It should however be possible to apply a high degree of mechanization covering operations subsequent to picking, particularly if the long row 'hedge' system of planting is adopted to allow freedom of manoeuvre and economical movement through the orchard.

The N.I.A.E. is developing a range of such equipment. This includes the design of a relatively simple low slung trolley to carry one bin of fruit capable of being pulled by one person, but with some device to give a mechanical advantage where ground conditions are difficult. For the next stage a power bogie has been designed which allows bins to be moved by a team of pickers as they progress, the bogie operator also making some contribution to the picking.

A more sophisticated machine is a self-loading vehicle which can pick up bins on its fork-lift and then run them back by a built-in conveyor on to its integral transportation platform. The vehicle thus combines the functions of a fork-lift and a fully roadworthy transporter capable of operating at 13 m.p.h. on orchard tracks and 30 m.p.h. on a public road.

These developments have been made in conjunction with investigations into the damage factor, and suitability of different designs and sizes of bulk bins for a variety of commodities.

Measuring carbon dioxide enrichment

The increasing use of carbon dioxide to enrich glasshouse atmospheres, for improved cropping under favourable light conditions, has shown the need for an apparatus to estimate the concentration of CO_2 which is easy to use and cheap to manufacture. From information collected on all forms of gas analyser, it became apparent that whereas instruments such as an infra-red gas analyser were suitable for research purposes, no analyser commercially available combined the characteristics of low price, simplicity and reasonable accuracy required by the commercial grower.

A known published method of estimating CO_2 concentration used an indicator to give a colorimetric determination of the equilibrium pH value established when a dilute solution of sodium bicarbonate was in the presence of a CO_2 sample. But existing applications of the method were not thought to be sufficiently practical for general use and effort was directed towards the development of apparatus which would be easy and reliable in use and cheap to manufacture.

A simple bottle sampling method was devised for obtaining the equilibrium colour of the bicarbonate solution whilst negotiations with a manufacturer led to the adoption of a nine-step glass colour-standard disc covering CO_2 concentration for 0·02–0·4 per cent by volume and giving adequate resolution for most purposes. A complete kit, which includes a standard light source, is now available commercially; it is simple to use, has a sensitivity better than the majority of more expensive instruments, and costs only about 2*d.* per sample taken.

Machine precision seeding to help research

It cannot be expected that any major modification to natural conditions can be achieved artificially in the field, nor may any such modification be desirable. The research worker is therefore dependent, in his plant studies, on normal growth cycles and seasonal occurrences. An earlier achievement of results and the compression of experimental work in time are made possible, however, by the alternative method of giving the research worker mechanical aids and, through them, effective additional time to conduct a larger number of simultaneous investigations.

One such machine recently made for another research institute is the single plant culture seeder. The machine has a $1\frac{1}{2}$ h.p. engine and walks over a plot by means of two pairs of skids, driven from a reciprocating rod, each pair striking the ground alternately.

At each step twenty-three tubular dibbers enter the ground and internal plugs are withdrawn to allow seed to fall through. One seed is fed to each dibber, at each step, from a magazine which holds fifty rows of seeds. The machine thus sets twenty-three seeds 2 inches apart in each row, with 6 inches between rows at a time cycle of 6 seconds per row. The complete seeding of a plot with 1,150 seeds, accurately placed, takes approximately five minutes.

Materials and machines

The reliability of machines depends not only on the quality of materials used, but also upon the treatment the materials receive during processing into component parts. The effect of treatments in manufacture has been highlighted during fatigue tests of commercial spring tines, made to confirm reported disparity in performance between British and Continental products manufactured from hot rolled strip. In all cases of failure fatigue nodes were found at surface irregularities and inclusions, whilst surfaces were found to have suffered an extensive loss of carbon. Different or additional treatments in manufacturing processes will therefore be essential if the life in use of such components is to be materially improved.

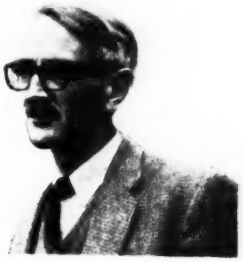
These and many other subjects under investigation at the National Institute of Agricultural Engineering are described in the Institute's Annual Report 1962-63, price 21s.

SPECIAL WEED CONTROL FEATURE

Weeds in Grass

John Davies, B.Sc.

Herbicides have a part to play in the grassland story and much is being done to discover chemicals which can lead to an improvement in the quality and utilization of our existing pastures. Too often improved utilization is bedevilled by weeds which limit the usefulness of our pastures. It should never be forgotten that the weed is more often a legacy of pasture mismanagement. New chemicals will only be worth while in *hastening* the improvement process, whereby with better management the productivity of our pastures can be raised.



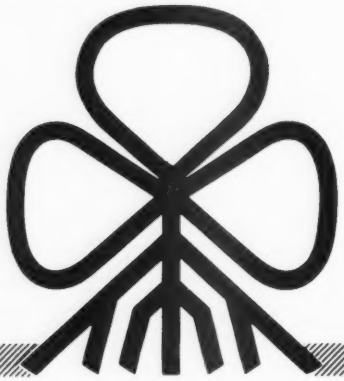
The author of this article has served in the N.A.A.S. as an adviser on grassland problems since its inception. First appointed to the West Midland region, he became regional grassland adviser to Wales in 1959.

Weeds in Arable

Stanley Evans, B.Sc., Dip. Agric.

Greater flexibility in rotations, reduction in labour demands, greater crop mechanization, better yields and improved crop quality are some of the direct results of using weed-killers. A look at current practice also reveals, on the other hand, a number of weed problems which are difficult to deal with under present systems of arable cropping.

Stanley Evans has been the N.A.A.S. Liaison Officer with the Agricultural Research Council's Weed Research Organization at Oxford since its inception in 1960. Author of the book *Weed Destruction* and joint editor of the *Weed Control Handbook*, he is well known as a contributor to this and many other farming journals.



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SUMMER Basic slag* is often easier to apply in summer to closely grazed pastures, on low lying land, and especially to hay or silage fields immediately crops are cleared. You also get a better choice of the good grades at this time.

AUTUMN You'll want basic slag* for new "seeds", and for the regular 3-yearly dressing on all grassland. Seize every chance to spread it before the weather deteriorates. It's also the ideal phosphate fertilizer for winter wheat and beans on heavy land.

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* *On land needing both phosphate and potash—use potassic basic slag or K-Slag.*

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Weeds in Grass

John Davies

THE concern of the grassland farmer in recent times has been to grow those 'two blades of grass where one grew before'. Unfortunately the world of grass does not deal with the grass plant alone, or indeed with any single grass. Our pastures are something like Joseph's coat; there are grasses varying from perennial ryegrass to Yorkshire fog. These seldom live alone; the clovers and the inevitable broadleaved weeds grow along with them. Hence the difficulty and the argument—when is a grass a weed in a pasture? Indeed when is a broadleaved 'weed' one? In the arable field the distinction is quite clear—a weed is indeed 'a plant out of place'. Anything other than the crop sown is treated with scant respect and nowadays there is usually a chemical to deal with it. The picture is clear; if the weed interferes with crop yield, then out it must go.

But in grassland the value of the crop is seldom, if ever, direct—as it is with say a cereal crop. The produce has to be eaten by the animal before we can appreciate the true value of any treatment. It is for this reason, perhaps for more than any other, that less attention has been given to the grass 'weeds' than to those in arable crops.

Even in grassland we recognize that no case can be made for weeds such as bracken, equisetum, ragwort, thistles and docks. But we also recognize that most of these weeds are the result of a poor soil condition or malpractices in management. Any chemical for weed control must inevitably need an accompanying change in the grazing or cutting management. Failure in this will inevitably be followed by a reinvasion. This is true of most of our troublesome grassland weeds; developments in chemical control can only hasten the process of their removal; other (management) changes must accompany the treatment.

On balance, despite the 'red herring' of possible stock value of certain weeds (yet to be proved!), most of our grassland consists of too many useless weeds. They occupy ground which better grasses and clover should fill if better use is to be made of the product as grazing, silage or hay. Indeed the limit to better utilization often lies at the feet of the weeds now present in our pastures.

Undersown and direct-sown leys

Here we still have the problem of finding a chemical which will give an all-round control of broadleaved weeds which are troublesome. In the direct-sown leys the mower still seems to be as good a practical and cheap method as any. Clover remains the 'nigger in the woodpile'; and this more often is the real consideration when wondering which chemical to use. Hence the continuing popularity of butyric compounds such as MCPB or mixtures

PLANT PROTECTION
leads in weed control

'GRAMOXONE' W

This product, based on I.C.I.'s discovery paraquat, has many applications on the farm. It kills both grasses and broad-leaved weeds, being particularly effective against grasses. Some uses are:

Stubble cleaning — to make ploughing and cultivations easier and to reduce grass and weeds in the following crop.

Pasture renewal — especially on unproductive land in low lying areas, in hill country, moorland, stoney soil etc. which is difficult to plough.

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For weed control in forestry — particularly for use in young plantations and for cleaning up planting lines prior to planting.

'PREEGLONE' Extra

This product is similar to 'Gramoxone' W but is particularly effective for the control of broad-leaved weeds, and has many of the same applications as 'Gramoxone' W. Particular uses of 'Preeglone' Extra are for pre-emergence weed control in potatoes, all row crops, and inter-row weeding in soft fruit and vegetables.

'METHOXONE' Extra

This is an extra wide range selective weedkiller for efficient and economical control of weeds in cereals.

'BUTOXONE'

This is a new wide range selective weedkiller for use in cereals undersown with grass-clover mixtures, direct re-seeds and young ley.

'AGROXONE' K

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including them. The problem remains—there is still room for the 'better chemical'. In these days the heavy user of nitrogen is often less interested in the clover plant, so the problem is simplified. The treatment is then similar to that with cereals—opening up a wider range of possible chemicals.

It is interesting to note the approach in the cereal field where the attack on the weed is being directed before the sown crop or even the weed has emerged. Chemicals such as paraquat and pentachlorphenol are being used in this way.

The move toward limited cultivation using chemicals such as paraquat in cereal production raises interesting speculation. The vulnerability of weeds when undersowing may be increased in this form of husbandry; special care may need to be taken when weeds such as *Poa anna* and more vicious grasses such as couch are present.

Herbage seed crops

The seed producer faces the problem of producing the cleanest crop possible; clean in the sense of weeds—any other grass or broadleaved weeds. Impure crops lead to losses of seed in the cleaning process and even the risk of losing a certificate. Either can mean a loss of income.

In the older grass stands there is also the problem of controlling invasion from self-sown plants of the variety being grown; this may be desirable in producing an authentic grass variety. Hitherto the grower has resorted to mechanical means of weed control, both during establishment and in the established crop. But more and more, chemicals are offering a cheaper means and a surer practice. Pentachlorphenol and paraquat are showing their value in the pre-emergence techniques for the control of black grass seedlings.

In established stands, Prometryne (1½ lb/acre) is being given as a tentative recommendation when dealing with seed crops of perennial ryegrass, cocksfoot, timothy, meadow fescue and tall fescue on medium and heavy soils. Sprayed in the autumn, a control of seedling grasses, including black grass, can be obtained. For direct-sown crops, at least four months old, the seedling grasses to be controlled should have germinated and have no more than three to four leaves.

Again, for invading weeds, paraquat at 2–4 lb per acre, as an after-harvest treatment, used with a drop delivery spray mechanism between the grass rows has proved effective.

Established grassland

The new thinking in established grass is less clear, certainly in the use of herbicides as against other less costly methods of weed suppression. As has been said, many lowland swards are weed-ridden—buttercup, thistles and rushes are common. Most can be treated effectively with chemicals, but because these chemicals depress white clover, they should be used carefully. Where white clover growth is strong, herbicides can be used with certain knowledge that the clovers will recover. Where clover growth is weak, the use of herbicides is inadvisable in the first instance. Encouragement of the grasses and clovers by fertilizers and frequent cutting and grazing reduce the vigour of weeds and often avoid the need for spraying at all. If necessary chemicals can be applied later in the programme, when lower doses may be more effective.

Docks are one of the more serious weeds of even the more intensive, better managed grass pastures; so far most herbicides have proved ineffective on well-established docks. Provided the white clover plant can be ignored, and there are such situations, then the chemical dicamba (2 methoxy 3·6 dichlorobenzoic acid) has distinct possibilities.

Chemical ploughing

The possibilities offered by chemicals to limit the necessary cultivations in reseeding or renovating or reclaiming land are being pursued. Dalapon first made this a commercial possibility, but persistence of the chemical in the soil and its inability to control a wide enough range of weeds limited its use, except in special circumstances. Paraquat has since appeared on the scene, and here too we have yet to find the perfect chemical to give us a performance under all conditions of reseeding without the use of severe cultivations. Indeed, except for the open sward, with susceptible plants and sufficient moisture, there is no guaranteed success of establishing sown grasses and clovers. Where mat and close sward conditions are to be dealt with, severe cultivations are necessary to establish the grasses, though clovers often establish without cultivation. Buried weed seeds can also be troublesome following sward destruction, and the problem of how best to deal with the dead trash remains unsolved.

It is certain that the use of chemicals in this way is the beginning of a new era in pasture development and improvement. It may well be that specialized methods of sowing with drills designed for the purpose will be required to ensure success. Even pre-treatment of the seed may be a necessary adjunct if the use of herbicides is a way to finding a cheaper alternative to ploughing and reseeding.

Weeds in Arable

Stanley Evans

THE assiduous work of the chemist and biologist has given the farmer and grower so wide a range of selective herbicides that today specialized knowledge of their use is becoming increasingly necessary if the best control of weeds is to be secured. Selectivity, inherent in the chemical, can be influenced in many ways. Most important is the dose at which the herbicide is applied and the stage of development of the crop and weed when it is applied. Attempts have been made to improve selectivity by manipulating application techniques, and among these are the formulation of herbicides as granules, changing the droplet size of sprays, the use of charcoal to protect plant roots from soil-applied herbicides, the application of bituminous mulches to influence soil moisture which so markedly affects the activity of soil-applied herbicides, and the use of various methods of incorporating herbicides in the soil.

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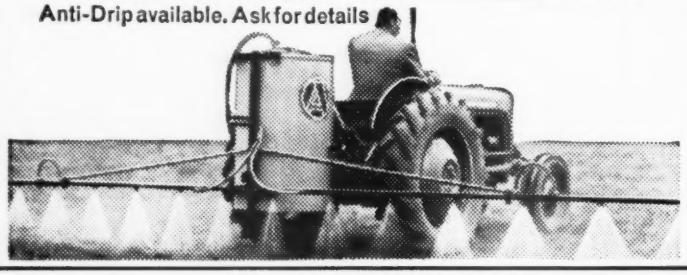

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Weed Control Handbook

Issued by the British Weed Control Council and edited by E. K. WOODFORD, O.B.E., PH.D., D.I.C., and S. A. EVANS, B.SC., DIP.AGRIC. *Foreword by* SIR HAROLD SANDERS, M.A., PH.D. *Fourth Edition*, 1965. 448 pages, 8 illustrations. **32s. 6d.**

This new edition of a famous handbook has been divided into three parts for ease of reference. The first deals with the herbicides themselves, the second with recommendations for the use of herbicides, and the third with methods of applying herbicides and matters concerning their safe use. An additional aid to ready reference is the use of coloured paper for the index to the recommendations for the use of herbicides on crops which appears at the beginning of the second part, and for the two tables at the end of that part which show the response of weeds to herbicides. The handbook is once again intended for all who are concerned with the practical or technical aspects of the subject, and the aim has been to cover *all* questions that can arise in the chemical control of weeds.

Insecticide and Fungicide Handbook for Crop Protection

Issued by the British Insecticide and Fungicide Council, and edited by HUBERT MARTIN, D.SC., A.R.C.S., F.R.I.C. 1963. 308 pages, 2 illustrations. **32s. 6d.**

"This is the book that has been awaited with considerable interest; it is the companion volume to the *Weed Control Handbook*. It is thus an essential tool, the received work, the bible of the pesticide user and, under the editorship of the leading authority on the subject, it is the last word on rates of usage, safety and precautions in dealing with pesticides."—*Agriculture*.

Farm Pests—an Aid to their Recognition

T. E. TROUGHT, M.A., DIP.AGRIC.SCI. *Foreword by* J. L. HUNT. 1965. 72 pages, 32 colour plates. **12s. 6d.**

This book, produced in co-operation with the Shell Chemical Company, illustrates those insect pests which are of economic importance and common occurrence in farm crops. Both farmer and agricultural student should find it an invaluable aid.

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Few herbicides deal satisfactorily with perennial weeds such as bindweed in maize

Few of these studies have, however, led to widely adopted new practices. The farm sprayer applying 10–60 gallons of liquid per acre through jets at a pressure of 10–40 p.s.i., still applies most of the weed-killers. Without any greater sophistication of application techniques, herbicides, put on in the right quantity and at the right time, show marked selectivity. Indeed so many herbicides perform well even with indifferent application that farmers tend to forget that selectivity does depend upon the correct dose being applied evenly over the field. Faulty nozzles, incorrect setting of the machine and bad operation can be dangerous.

Herbicides and husbandry

Before the discovery of barban and di-allate it was often said that it would be impossible to get a chemical to kill one cereal—wild oats—without harm to another such as wheat or barley: this was expecting too much. But now there are several examples of chemicals able to select between two closely related plants—for example, sodium monochloracetate for charlock in kale, pyrazone for fat hen in sugar beet and dalapon for killing one species of grass in a mixed sward. It no longer seems impossible, given time, to obtain any type of selectivity required.

Modern husbandry techniques are based on the need for cultivations for weed control. The plough owes its pre-eminence to its capacity for burying weeds and weed seeds; crop row widths and planting dates are influenced by the need for mechanical weed control. In the absence of weeds in crops, a situation promised in the future by the advancing technology of herbicides, the question has to be posed as to what cultivations will then be needed. What soil conditions should be aimed at, and will a change in the spacing of crop plants lead to better yields? What subsequent modifications in planting and harvesting techniques may be required? Can the structure of crop husbandry be changed to our benefit?

Perennial weeds

Among perennial weeds, the outstanding current problem is perhaps that of couch, particularly where cereals are grown intensively. It is a problem that needs tackling with vigour; every agent for its destruction must be considered. Chemicals such as dalapon and amino-triazole if used properly—and this

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means suitable cultivation treatments following spraying designed to discourage regeneration of any surviving couch—can reduce infestations considerably; even partial control gives improved crop yields. Application is usually made in the autumn after harvest and normal cropping continued in the following spring. The herbicides have to be applied to actively growing couch foliage, and the more shoots per unit length of root the better the chances of a good control. For this reason, rotary cultivation of the couch and spraying of the regrowth is sometimes advocated.

This means, however, that a fairly long period of growing weather between harvest and the onset of winter is required. This may occur in the south but in more northern parts of the country, where harvests are later and the onset of winter earlier, the chances of using amino-triazole or dalapon successfully, even without rotary cultivation, are much less. An alternative is rotary cultivation alone. The aim is to chop up the roots to encourage sprouting of dormant buds which are killed by further cultivation. The process continues until all buds have sprouted and been killed.

But prevention is better than cure. With couch, for which there may be no certain cure—even the bare fallow can be an uncertain business—prevention is particularly important. Special attention should be given to headlands, which are often the first areas of ingress for couch. 'Barrier' spraying with a herbicide, possibly at a heavier dose than normal, or regular extra cultivations, may be worth while.

Other perennial weeds are of increasing importance. Under the continuous use of weed-killers for annual weed control—and many farmers spray the major part of their cereal crops regularly—there is a change in the annual weed flora of many arable fields. This observation has prompted the suggestion that weed-killers have also led to the increase of couch and other perennial weeds. This seems an unwarranted aspersion. Heavier cropping with cereals, particularly with winter-sown crops, limits the cultural means of controlling perennial weeds. The traditional cleaning crops in the rotation are reduced or eliminated. It is not really surprising that under these conditions perennial weeds may, if given the chance, become troublesome. Chemical control of these weeds is uncertain and some show marked resistance to existing herbicides although newer materials hold out better promise. Meanwhile, a high standard of cultivations and vigorous competitive crops are the most effective weapons.

Annual weeds in cereals

For the control of annual weeds in cereals, the farmer can choose from more than 150 commercial products. They may be either single chemicals or mixtures of two or more chemicals. About a dozen basic chemicals are involved, prepared and mixed in different ways. The very multiplicity of products makes the choice of a herbicide for any particular situation very difficult. One new herbicide (available in the form of at least three proprietary products) has been introduced this season and more are likely in the near future. These latest developments are contact, not translocated, herbicides, and one is even a relation of the well-known DNOC. Whilst contact weed-killers for cereals have an old-fashioned aura about them, it is worth remembering that herbicides like sulphuric acid and dinoseb, whatever their faults, give a good control of a wide range of weeds. The new chemicals are aimed at two weeds for which there has been no wholly satisfactory treatment up to now—mayweed and corn marigold.

Perennial grasses are particularly troublesome where cereals are grown intensively

Root crops

There are still some crops for which especially suitable chemical weed-killers have not been developed. The grower of turnips or swedes can try only contact pre-emergence treatments—of limited value. To encourage weed growth before crop emergence, a seedbed is sometimes prepared a week or ten days in advance of sowing, but the success of a stale seedbed is still dependent upon getting weather suitable for weed germination. By precision seeding, developed primarily for sugar beet, swedes and turnips can be grown comparatively cheaply nowadays. But there must be weed-free conditions. If we had a satisfactory weed-killer a greater acreage of these crops might be grown.

There are several herbicides for potatoes nowadays, although the advantages of using herbicides instead of cultivations have still to be clarified. Cultivations, it seems, may encourage greater incidence of some diseases, and some types of cultivation may be definitely harmful to the crop. Inter-row cultivations, too, may encourage the formation of soil clods which are difficult to separate mechanically from tubers at harvest time. On the whole farmers have been cautious in using chemical weed-killers in potatoes. The greatest effect of their introduction has possibly been to make us look again more critically at cultivations and to consider cultivation of potatoes in beds to improve the yield of ware-size tubers. There are difficulties in the bed cultivation of maincrop potatoes (not least the harvesting of the crop) and the technique has not been adopted. With carrots, the story is quite different. Many acres are grown in beds, weed control being achieved by herbicides such as linuron. This is conferring a great advantage by increasing the yield of marketable roots.

Herbicide residues

Many new residual herbicides have become available in recent years. Applied to the soil, they remain for some time killing weeds as they germinate. Applied about the time of sowing the crop, they have several advantages over weed-killers used after the crop has emerged. The principal one is that weed-free conditions are maintained during the early growth of the crop, the time when weed competition is most serious.

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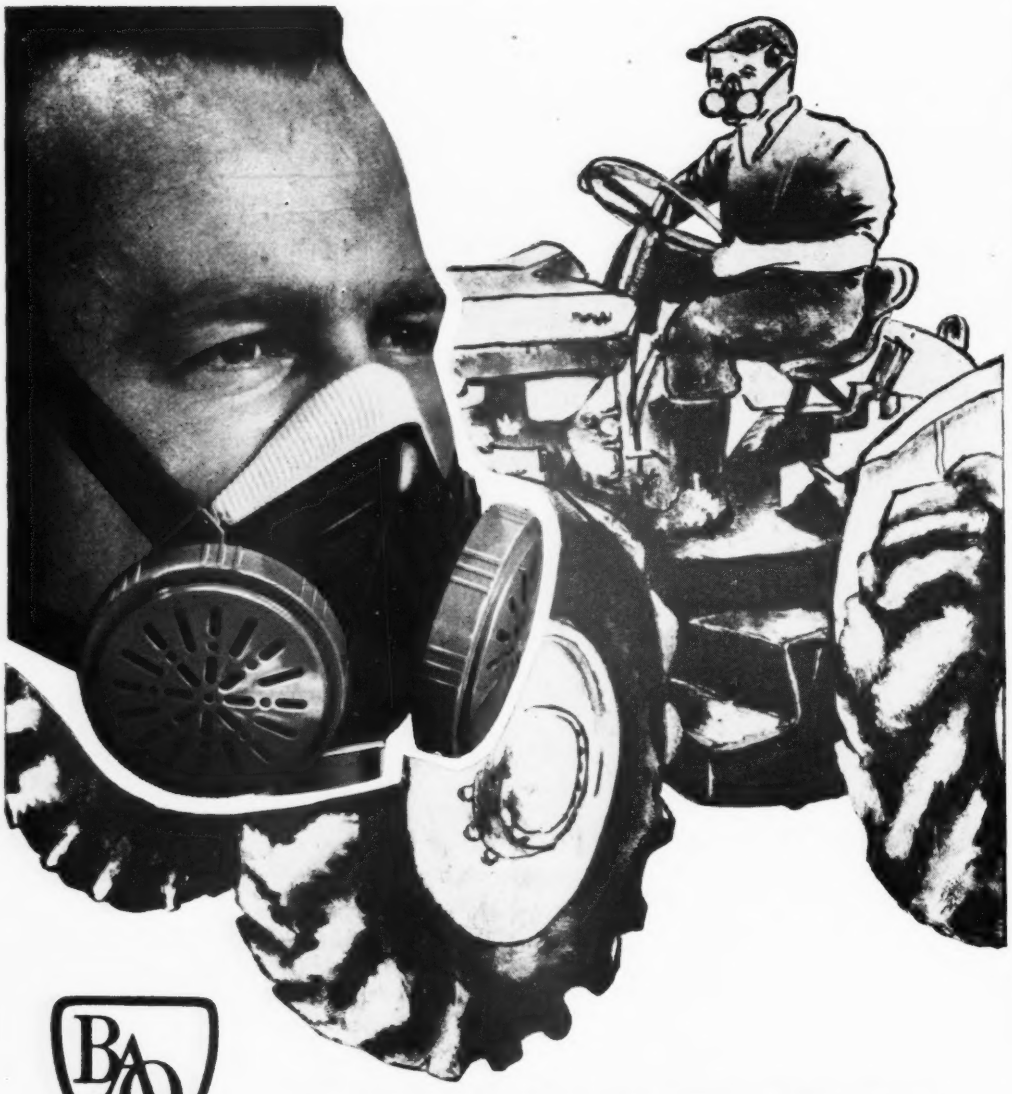

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Selectivity often depends upon the chemical staying near the soil surface and not penetrating in damaging amounts to the roots of the crop which may be in some degree sensitive to the chemical. This is known as 'depth protection'. The movement and persistence of the herbicides in the soil is therefore of considerable importance. One of the largest factors involved is adsorption of the herbicide on to clay and organic matter in the soil. Adsorbed herbicide becomes immobile and relatively ineffective; and since the adsorptive capacity of soils varies, the dose of weed-killer may have to be adjusted to allow for this. Two products for weed control in sugar beet are sold on the basis of soil tests to determine the dose. Because the movement of herbicides in the soil is principally in soil moisture, rainfall is also a very important factor.

'Persistence' in relation to selective herbicides in the soil is measured in terms of months or weeks, and the greatest danger is to following crops rather than man and wild life. Trouble can arise from careless overdosing, but sometimes the failure of a correctly-treated crop can lead to difficulties. For example, autumn-sown field beans treated with simazine may be killed by a severe winter. The simazine residues in the spring can be sufficient to damage any sown crop other than those tolerant of residues such as spring beans or maize.

Residues in crop remains have recently presented a problem. Straw from cereal crops treated with 2,3,6-TBA in the normal manner has contained residues sufficient, when used as compost in the glasshouse, to badly affect very sensitive crops such as tomatoes and cucumbers. Growers are now advised not to use such straw, and special efforts have to be made to obtain straw from farmers who do not use this weed-killer. Research will be required with new herbicides to assess similar dangers.

Changing husbandry

We have come a long way from the early days when a chemical weed-killer was simply a replacement for the hoe. Nowadays there are many chemicals which have different modes of action and which are formulated and used in many ways. They are used on many crop varieties, and varieties of a crop may differ in sensitivity to some herbicide treatments. Herbicides are applied at various stages of crop growth. The growth of plants is modified according to the environment, and their reaction to herbicides may be thereby influenced. The husbandry of crops is changing, largely as a result of using modern herbicides and pesticides. Consideration has to be given to the effect of this on the efficiency of the herbicides themselves and upon the soil, the weed and crop growth and so on. There are so many chemicals available that a crop may be treated more than once in a season. Not only must the interaction of herbicides be considered—and there is substantial evidence that one herbicide can interfere with another, modifying its biological activity—but also the interaction of herbicide with other growth-regulating products, insecticides and fungicides.

Chemicals are a potent means of influencing crop production and their use will extend. The farmer will have to consider their action on crop and pest, their interaction with each other and their influence on the method of crop production. Indeed what might be called a crop pharmacologist may well be soon required to advise on the use of the many 'crop protection' products available.

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THE ultimate aim of every tomato grower is to increase profit, and disease control must always be considered from this point of view. Control of the virus disease Tomato Mosaic, which considerably reduces yield, is obviously economically worthwhile, but other diseases which do not always cause large reductions in yield, require very careful consideration when planning for a maximum profit return. A small loss in yield or quality is not sufficient justification for the expense of fungicidal materials and in particular the labour costs of high volume spraying.

If diseases could be avoided by growing resistant varieties or manipulating glasshouse environment, this could be more economical than using chemicals. Unfortunately there are no varieties available which are resistant to every tomato disease or even all the common diseases, although some varieties are resistant to individual diseases. Control by manipulating the environment can produce excellent results, but the techniques involved have not yet been fully investigated. No amount of environmental adjustment will control such soil problems as Verticillium wilt or Didymella stem rot. At times the cost of chemical control can be reduced by using low volume methods, aerosols, or smokes, but the range of such materials is not yet sufficient for a complete disease control programme.

Verticillium wilt

Wilt (sleepy disease) can be caused by either of the two fungi *Verticillium albo-atrum* or *Verticillium dahliae*. The first is by far the most common

cause of wilt in the Lea Valley; the second appears to be the dominant cause in the Sussex glasshouse area. Attack by either gives very similar symptoms—yellowing and wilting of lower leaves, often with recovery in the evening and at night. Eventually the yellow leaves turn brown and the plant wilts permanently and dies. The stem of such a plant, when cut, shows a marked brown staining in the water-conducting tissues, although this symptom on its own does not always point to Verticillium wilt.

Both fungi can exist in the soil between crops and infect the plants through the roots shortly after planting. The fungus enters the water-conducting system, and it is this that causes wilting. Generally the first wilted plants are seen in mid-April, which is about 6–8 weeks after planting. Severe attacks at this time incur the greatest economic loss. Symptoms of wilting may again be seen from September onwards. It is very difficult to predict the incidence of wilt on a nursery, and a severely wilted crop can sometimes be followed by a healthy one with a minimum of soil sterilization between crops.

If Verticillium wilt is always a problem on a nursery there are a number of possible ways of combating it. First, if possible, steam sterilize the soil. This is expensive but there is no alternative if there is a risk of the occurrence of wilt early in the crop. Normally, steaming for 30 minutes with grids, spikes or pipes gives an adequate, though not complete, control. Strip steaming (i.e., leaving the paths) is too risky if the attack is severe. If wilt has not been severe, steaming only every other year may be a worthwhile risk.

Without steam the choice lies between chemical sterilization, grafted plants on resistant rootstocks, or some form of physical barrier preventing contact of the plant roots with the infected house soil. None of the chemicals on the market gives a satisfactory control of wilt. When choosing a chemical, think first of the other problems and not the wilt. Whichever chemical is used, the plants must be on resistant rootstocks. Special care must be taken at planting to ensure that the susceptible scion cannot root into the soil; the graft union must be kept well above the soil and above the level of any subsequent mulch.

Recently at the Lee Valley E.H.S. tomatoes have been grown successfully on straw bales. Yields have been good even when the bales were stood on polythene, and this technique definitely offers a new method of wilt control. Usually the plants are planted in a small soil bed on top of the bale which itself has been previously treated with fertilizers (details of the method can be obtained from the Director, Lee Valley E.H.S., Hoddesdon, Herts). This method may not be applicable to low houses, where any reduction in the available height would not be profitable. The management of straw bales calls for special attention, particularly the water and nutritional needs of the plants.

Didymella stem rot (*Didymella lycopersici*)

Some nurseries have a history of *Didymella*; others, although growing tomatoes regularly, rarely or never encounter the disease. The reason may be the difficulty of ridding the nursery of *Didymella* once well established. Although thorough soil sterilization reduces disease incidence to a low level, a few infected plants seem to occur early, followed by rapid spread. Perhaps one of the main reasons for the build-up is the difficulty of differentiating

between stem cankers due to *Didymella* and those due to *Botrytis*. The control of *Botrytis* can be achieved by careful cutting out of cankers, but this method, if used to control *Didymella*, will only ensure rapid spread! Every cut with the knife will reinfect the stem.

The first symptom of attack by *Didymella* is usually wilting, particularly in sunny weather. The base of the wilted plant will have a brown decayed area or canker at soil level. An infection of this type may have originated from contaminated propagating or house soil, infected seed, or contaminated stakes. The spread of the disease by water splash, or by workers' hands or knives, produces numerous cankers on the stems at various levels above the soil, and the fruit may also become infected.

If *Didymella* is a persistent disease on a nursery, every effort must be made to control it. The most important single source of this disease is probably plant debris. Contaminated debris may be responsible for the reintroduction of the disease into the house soil or, worse still, the propagating soil. It is therefore essential to clean up the house thoroughly after the previous crop. Green tomato plants are difficult to burn, and if an incinerator is not available it is probably better to clear the haulm off the nursery well away from any tomato crops. Houses are best washed down with 2 per cent formalin and the soil steamed or drenched with formaldehyde or metham sodium. Old strings must be removed and any stakes used should be soaked in 5 per cent formalin for 48 hours.

A successful planting treatment devised by the Glasshouse Crops Research Institute is to spray the plants within two days of planting with 0·25 per cent captan (5 lb of 50 per cent wettable captan in 100 gallons water), concentrating the spray on the base of the stem and the soil directly around the plant. Not more than 3 fl. oz should be applied to each plant. A second application is made three weeks after the first, but using 10 lb of 50 per cent captan in 100 gal water and 5 fl. oz per plant.

Any infected plants should be removed and burnt without handling the canker, and in no circumstance should attempts be made to cut out the canker with a knife. It is best to avoid cutting out any lesions if there is any risk that some of them are caused by *Didymella*. Trickle irrigation will reduce water splash and thereby help to avoid disease spread.

Leaf mould (*Cladosporium fulvum*)

Cold house crops frequently suffer severe attacks of leaf mould. Yellow areas are seen on the upper surface of the leaf and brown fungal patches appear on the undersides. Sometimes, when the disease is severe, these patches cover nearly all the leaf surface. Eventually severely-infected leaves turn brown and die. Generally the disease starts in June or July, although it may be seen as early as April in heated crops. The lower leaves are first to become attacked, and spread (mainly the direct result of the distribution of spores in the air by air movement or water splash) takes place up the plant until most leaves become diseased. These spores appear to be particularly resistant to low temperatures and also drought. It is generally believed that the disease survives from season to season by means of these spores.

Leaf mould develops particularly in conditions of high temperature and high humidity—conditions common in May–July, particularly in the evening and at night following a warm day. Ventilation during the day generally keeps the humidity below the critical level, although the temperature may be

Leaflet infected with leaf mould. Brown fungal patches are seen on the underside. Yellow areas appear on the upper surface

Botrytis stem lesion resulting from infection through a leaf scar wound

favourable. The use of carbon dioxide enrichment in tomato crops creates ideal conditions for the development of leaf mould during the day because the ventilators have to be kept closed to prevent loss of the gas. Immediate control measures must be taken as soon as the first spot is seen. Ideally, the circulation of dry air through the crop will reduce the likelihood of leaf mould attack, and this can be easily achieved in heated houses by maintaining a small amount of pipe heat together with some ventilation. This is particularly important during the evenings and at night in May, June and July.

In a cold house all possible ventilation should be given on warm days, using the doors at each end of the house as well as the ventilators if necessary. Removal of the lower leaves will also allow greater air movement. Even with such ventilation it may be difficult to prevent leaf mould building up in a cold crop. At this stage a decision will have to be made about the application of fungicides. All high volume sprays leave a deposit on the fruit and the removal of this, together with the expense of application, will increase the cost of fruit production.

How much does leaf mould reduce the crop; does a small amount matter? There are as yet only a few experimental results available on this. Experiments at G.C.R.I. have shown that considerable foliage can be removed from a tomato plant before yield is affected. This substantiates the results of some N.A.A.S. experiments which have shown that quite high levels of leaf mould have little or no effect on weight or quality.

A cold crop is best sprayed when the disease is at a low level and further applications made only when the attack is obviously increasing in intensity. The best fungicide available, particularly for a severe attack, is freshly precipitated or tank mix zineb. This is made by adding $1\frac{1}{4}$ lb zinc sulphate to a solution of nabam (93 per cent) containing $1\frac{3}{4}$ lb per 100 gallons. Some proprietary products based on copper, particularly combined with white oil,

give a satisfactory control of slight attacks of disease and have the advantage of leaving less deposit on the fruit.

Varieties are now available that are resistant to all known strains of the fungus. The Eurocross varieties and a number of new varieties from G.C.R.I. are particularly promising.

Grey mould (*Botrytis cinerea*)

Botrytis probably accounts for more crop loss than any other fungal disease of tomatoes, and is particularly troublesome in cold crops. Losses occur at any stage in the growth of the crop, and if the attack is severe even the fruit may be unmarketable because of ghost spot symptoms. Stem lesions are perhaps the most common symptom and these are usually associated with a wound of some sort. If untreated the lesion will eventually girdle the stem and the plant will die. The characteristic grey-brown mould can be seen sporing profusely on the parasitized stems. During propagation, plants are often lost because of similar stem lesions which develop at soil level.

Young tomato plants have a degree of resistance to *Botrytis* attack, but this is readily broken down if the fungus can first become established on dead or senescent tissue. Yellow or wilting cotyledon leaves are ideal starting points for the entry of *Botrytis*. Very often the attack of young plants results from potting them too deeply, so that the cotyledons are below soil level, or allowing them to dry out so that the cotyledon leaves wilt severely and become prematurely senescent. Later in the crop, lesions develop mainly around the leaf scars. Conditions of high humidity seem to encourage attack by this fungus and, here again, pipe heat and ventilation will keep the disease at a very low level.

In cold houses, where this is not possible, some chemical treatment may be necessary, particularly after all possible measures have been taken to improve air movement in the crop. Many growers cut out stem lesions, but this is risky as these are not always readily distinguishable from *Didymella* cankers. Painting the stems with creosote or a slurry of captan has been successful in many cases and, although this is a time-consuming operation, it can be well worth while. Most of the foliar sprays seem to have little controlling effect on *Botrytis* if conditions within the crop are favourable for the spread of the disease.

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Now is the time to deal with

Flies in Poultry Houses

J. M. G. Gradidge

As every poultry-keeper knows, flies are a very real menace in his houses, spreading both discomfort and disease. There are, however, other problems, not the least of which is the nuisance that flies which breed in poultry houses can cause to nearby householders. Public Health Inspectors and others get innumerable complaints on this score, and some, indeed, have led to legal action.

Of the many species of flies known in this country, only about a dozen breed regularly in poultry houses. Some, like the dung flies, stay close to their breeding places and may only annoy those who work in the poultry house. Others, like the common house fly, favour poultry houses for their breeding and may occasionally cause annoyance outside. But it is the lesser house fly (which Linnaeus classified as *Fannia canicularis*) that has caused most concern over the past ten years or so in Britain and the U.S.A.

Habits of the lesser house fly

Before describing the ways in which the lesser house fly can be controlled, it is important to understand its life history, and in particular the times when it is active.

The lesser house fly will breed anywhere that rotting vegetation and animal remains are found, and birds' nests and under pigeon roosts are specially attractive. Accumulations of chicken dung in droppings pits of the modern poultry house, or under batteries, are ideal, and flies can (and do) breed there in very large numbers. Such places are often warm enough for breeding to continue all the year round, but the flies are most active from April to October.

The females start to lay their eggs in March, depositing them either directly on the droppings or on the sides of the pits. The grubs hatch out within a day or two of egg laying and, after wandering for about twenty-four hours, burrow down into the mass of food. During the next eight days or so the grub may get itself down as much as six inches into the droppings. When fully grown it seeks the surface again and pupates in a dry spot. The adult fly may emerge from its pupa in as little as ten days but it usually takes much longer, especially in the cooler months of the year.

For ten days or more the female lays no eggs and often remains in and around the poultry house or on nearby vegetation. It is chiefly the males which travel further afield and pester householders by invading their homes—sometimes up to a quarter of a mile from the farm. Once the flies have got in through open windows or doors, they fly back and forth rather jerkily a few feet below the ceiling, often around lamps and other hanging objects. They may cause annoyance by getting into the eyes, nose or mouth, but every so often individual flies alight on walls, curtains or lampshades where they void drops of saliva which usually turn dark brown as they dry and can disfigure to such an extent that much time can be spent in cleaning or even repainting affected areas. The flies do not seem to be particularly attracted to food—probably because they prefer rotting material.

Fly strings

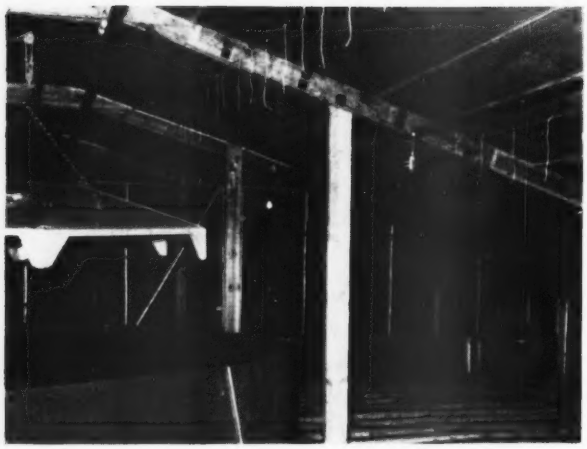
The nuisance must be tackled where it originates, namely in the poultry house. There are two main methods of control—putting up strings soaked in insecticide (fly strings) and spraying or watering insecticide on to the droppings. Of the two, the fly string is less time-consuming and cheaper. These strings last for six months or more, so if they are put up in April nothing more need be done that year, whereas spraying has to be repeated every month or so. Although spraying is usually impracticable if the whole floor of the house is slatted, it has the advantage of killing all kinds of fly, including the smallest which may annoy only those working in the poultry house. Sprays are also useful under verandah-type houses, where fly strings cannot be put up.

These fly strings are lengths of absorbent cotton cord, about $\frac{1}{8}$ in. thick, prepared by soaking them in a concentrated insecticide containing fenchlorphos. An hour is quite sufficient for soaking the string, but it should be left to drain overnight *and should be handled only while wearing rubber gloves.*

Because the lesser house fly settles readily on hanging objects, pieces of treated string hung inside a poultry house will quickly kill them. One or two contacts with the string are usually enough, and death occurs within half an hour.

Thirty feet of treated string is enough to treat a space with a floor area of 100 sq. ft. There are two ways of installing the string. One is to put the lengths just above head height from end to end of the house at intervals of 3–4 ft. The other is to space the lengths 7–8 ft apart and to tie additional pieces about a foot long on to these, so that the short pieces hang down at intervals of a foot or so.

The second method takes longer to prepare, but is more effective, since a larger air space is covered and the flies seem to prefer hanging objects. The single lengths must be installed 2 ft or more below the ceiling, and this may allow some lighter breeds of bird to try to roost on them. With the hanging



Fly strings put up in a wire-floored poultry house

string, the distance from the ceiling should be about a foot, unless the roof is very high. The string should be tied fairly tightly, so that it can be plucked to free it of dust accumulations every so often. Which of these two methods is chosen will have to depend rather on the design of the house and the habits of the birds.

Spraying the droppings

Treating the droppings with an insecticide is of only limited use because of the danger of poisoning the birds. When the house floor is all slatted or wire it is almost impossible to move mature birds out of the way for treatment if they are housed at the normal density, but with young birds the trouble is more likely to be the disturbance caused—which may lead to fatal panic. Another disadvantage with the complete slatted floor is that treatment must be done regularly, and in a large house this can be time-consuming. Where the droppings are confined to pits which make up only a small proportion of the total area, treatment of the droppings is quite practicable.

The most suitable insecticides are fenchlorphos and diazinon, which should be applied liberally as a dilute spray (about 0·1 to 0·2 per cent) at about a gallon per hundred sq. ft of surface area, and made up from a water emulsion. A watering-can with a rose or a sprayer with a coarse nozzle are most convenient for this work. The treatment should be repeated every 3 to 4 weeks. At present no other insecticides are safe or effective under these conditions of use.

Other methods of control

Spraying walls and ceilings has not been found effective, usually because the deposits are easily masked by dust and often soak into the insulation materials used. Also frequent use of the concentrated sprays needed to give an adequate deposit is undesirable because of the cost and the danger to the birds. Lastly, the lesser house fly prefers to settle on the less easily sprayed or inaccessible spots, such as electric cables, wire netting or the ceilings, so sprays have much less effect than would be expected.

Of other methods of fly control, electric mist generators dispensing pyrethrum need to be used daily to be effective. Insecticide vaporizers can only be used with any hope of success in houses without forced ventilation.

Flies are sometimes a nuisance in battery houses, and here fly strings are effective. However, it is better if the droppings are removed daily and stored dry until dispersed over fields. Automatic removal by scrapers and storage in tanks is probably the ideal, but this is economical only in large units. Where manure removal is inefficient there is usually enough food left for the fly larvae to complete their feeding. Flies often survive in battery houses because the larvae leave the droppings on becoming fully fed and fall to the floor, where they pupate. Frequent sweeping and burning of residues are then essential.

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The Ministry's Publications

Since the list published in the February, 1965, issue of *Agriculture* (p. 85) the following publications have been issued.

BULLETINS

No. 107. Soils and Manures for Fruit (Revised) 6*s.* 6*d.* (by post 6*s.* 11*d.*)
No. 131. Cauliflowers (Revised) 3*s.* 6*d.* (by post 3*s.* 10*d.*)
No. 152. Intensive Poultry Management for Egg Production (Revised) 6*s.* 6*d.* (by post 6*s.* 11*d.*)
No. 165. The Farmer's Weather (Revised) 5*s.* (by post 5*s.* 5*d.*)
No. 199. Low Cost Dairying (New) 3*s.* (by post 3*s.* 4*d.*)

ADVISORY LEAFLETS

No. 40. Small Ermine Moths (Revised)
No. 94. Maize for Fodder and Silage (Revised)
No. 151. Parsnips (Revised)
No. 223. Beet Eelworm (Revised)
No. 225. Cutworms (Revised)
No. 290. Spraing, Internal Rust Spot and Net Necrosis of the Potato Tuber (Revised)
No. 320. Poultry Manure (Revised)
No. 365. House Flies, Blow Flies and Cluster Flies (Revised)
No. 368. Insects and Mites in Farm-Stored Grain (Revised)
No. 484. Glasshouse Symphylids (Revised)
No. 535. Inspection and Certification of Fruit Plants (New)

HORTICULTURAL MACHINERY LEAFLETS

No. 9. Watering Equipment for Crops under Glass (New) 6*d.* (by post 9*d.*)
No. 10. Capillary Watering of Plants in Containers (New) 6*d.* (by post 9*d.*)

Single copies of Advisory Leaflets, up to a maximum of six different leaflets, may be obtained free from the Ministry (Publications), Government Buildings, Tolcarne Drive, Pinner, Middlesex. Copies beyond this limit must be bought from Government Bookshops (addresses on p. 154), price 4d. each (by post 7d.). Other publications are obtainable from Government Bookshops, from Divisional Offices of the Ministry or through any bookseller.

26. Maidstone East, Kent

S. C. Wyatt

THIS district, which stretches from the River Thames to the River Beult and from Maidstone to Faversham, is a 'high farming' area. The soils vary from the heavy clay of the Weald to the Folkestone Sands, and from the shallow chalk soils of the Downs to the deep Brickearths. The farms also vary—from the small intensive 10-acre units to the extensive marshland areas. Outputs vary from £10 per acre on the extensively grazed marshes to over £500 per acre on the hop and fruit farms.

The soil types run east to west through the district, producing distinct cropping areas. The highest output per acre is obtained from holiday caravans and chalets! This produces severe problems of trespass—particularly during the summer months.

The district has sufficient industry to attract labour, which makes life difficult on the intensive fruit and hop farms. These industries include glass-making and paper-making, as well as the shipyards in the Medway Towns.

Virtually every crop grown commercially in Great Britain, as well as the majority of the livestock enterprises, is represented to some degree in the district—cereals, potatoes, sugar beet, vegetables, fruit, hops, herbage seeds, legumes for canning and freezing, as well as grass. The livestock enterprises include dairying, sheep, poultry, barley beef, traditional beef fattening, single-suckling beef herds, pigs and rabbits.

But it is for its intensive market garden crops, fruit and hops that the district is probably best known. The deep brickearth soils grow pears, dessert apples, plums, black currants and gooseberries very well but, in particular, produce high quality cherries and hops. At Faversham there exists the largest private fruit co-operative in Europe, packing and marketing fruit for its members. The majority of the cherries produced in Great Britain are now grown in this district; the land at Teynham, on which King Henry VII's gardener is reputed to have planted the first cherry trees in the sixteenth century, has only recently been sold for development. The hops produce high outputs (£500 plus), the crop being sold through the Hops Marketing Board to the brewing industry. The delightful, old, round oast-houses used for drying hops are still a charming feature of the district. But no longer do we see the large-scale exodus of hop pickers from the East End of London in September; machine picking has become universal.

The large area of alluvium over London Clay bordering the River Thames is nearly all permanent grass farmed in big units between 400 and 2,000 acres.

The stocking rate is very low (1 bullock to 2–3 acres) and the main grazing animals are strong store cattle sold fat in the autumn, a great number of these beasts having come from Ireland. There are a few single-suckling beef herds and, naturally, fairly large numbers of Kent sheep. This area was seriously affected by sea flooding in 1953, causing heavy losses of animals and serious salt contamination of the soil.

Because of the high water-table on the marshes and their uneven surfaces, very little arable cropping takes place, but on a few small areas marshes have been levelled, dykes deepened and straightened, and full-scale tile drainage carried out. In these areas, provided the opposing views of the graziers and the arable men on water levels can be resolved, successful cereal cropping is possible. Some reclamation of saltings is going on by infilling with silt dredged from the River Thames. This, however, is likely to take 10 to 20 years before the land is really productive.

The clay with flints soils and the Brickearths are used intensively for market garden crops, particularly King Edward potatoes, Brussels sprouts, cauliflowers, beans and collards. Canning factories in Faversham, Ashford and Maidstone have led to large blocks of vining peas and beans being grown on the farms on this type of soil.

The chalk downs, with their thin soils and, in parts, steep slopes, were not considered to be highly productive before the war. But now, with newer techniques, large blocks of cereals, particularly barley, are being grown. A large area of grass is still used mainly for sheep production, although there are one or two large dairy herds. These pastures on the chalk and clay with flint soils are chiefly swards of Kent perennial ryegrass and Kent wild white clover; seed crops are taken regularly. Some of the pioneer work on the certification and standardization of these two seed crops took place in the district at Stalisfield. The soil down the escarpment to the Weald is Hythe Beds and capable of growing good crops of Bramley apples, strawberries and hops, as well as cereals, runner beans and grassland.

The Weald clay area suffers seriously from impeded drainage, and there is very little fall to the rivers, so making drainage improvement costly. This is an area of smaller farms with a great preponderance of grass used for dairy cows and sheep. Small areas of hops are associated with the rather better soil types. Apart from the hops, the outputs per acre are rather lower here because of lower stocking rates. The Weald, like the downs, is used for the production of Kent perennial ryegrass and Kent wild white clover seed. One of the most striking features of this area is the really delightful half-timbered farmhouses.

The small area of Folkestone Sand is used very intensively for strawberries, raspberries and French and runner beans. This is particularly true for those farms close to the rivers Stour and Len, where irrigation is possible and highly profitable. Irrigation is becoming more important and there is an ever-increasing interest in extraction of water from rivers and boreholes.

The district contains some of the highest-priced land in the country. The severe competition for land between farmers, businessmen, industry and urban development makes prices extremely high, and over £500 per acre is being paid for agricultural land. This high capital cost obviously puts considerable pressure on the farming within the district to produce high outputs and greater specialization. The result is that units are becoming larger. However, there will always be enough variety to keep the District Advisory Officer happy in this 'Garden of England'.

D. M. ANDREW

Agricultural Land Service,
Llandrindod Wells

Loose housing breeding herds

THE practice of loose housing suckler herds has become well established on farms in Breconshire and Radnorshire. This is due to the need to replace old buildings, to find additional accommodation for the spectacular stock increases resulting from hill land reclamation, and to provide a system of management that has a low labour requirement. The attractive prices made by the older and larger calves at autumn sales have led to a marked swing from spring to autumn and winter calving, and cows and calves now run together in the yards.

As with all new systems, problems have arisen, and before planning a new layout it is worth while considering the merits and snags of the buildings already erected, and also herd management practice. The time and place of calving, types of fodder (traditional hay, straw, oat sheaves and roots or silage), and size of herd, all influence building design.

Scour proved troublesome on many farms when cows calved down in yards, and to prevent spread of infection most farmers prefer to keep cows out of doors until three weeks after calving. This is feasible in October and November but can be difficult later in the winter, particularly on exposed farms where natural shelter is limited. Sometimes the old buildings are kept on for use as boxes, but often these are difficult to clean and disinfect and may be sources of infection if used for calving. Where outside calving is impracticable, due to time or exposure, it is worth providing some easily-cleaned boxes; about 1 box to 10 cows is required.

Conditions in the yards must be right for both cows and calves. To be profitable, single-suckled calves must be healthy and grow quickly but 'forced' conditions should be avoided because stock live out on upland farms for a large part of the year. Ease of working, initial and future maintenance costs, and adaptability are naturally important, particularly in the more remote areas where it is not only expensive but often difficult to get building work carried out.

Because wide spans are required, and in order to keep down costs, yards are usually of framed construction with corrugated asbestos roofs and brick or concrete block infilling walls. Often the yard is built as a lean-to against a Dutch Barn in which fodder is stored, but sometimes it is possible to use an existing, traditionally-built barn for fodder and erect a new cattle yard alongside.

A frequent complaint about modern yards is that they are cold, draughty and damp and that stock do better in the old buildings. These faults can be avoided without heavy additional expenditure if the buildings are carefully sited and designed. A south-east aspect is desirable, with shelter from both the prevailing westerlies and the very cold north-east winds that so often blow in late winter. In upland, high-rainfall areas, totally-covered yards are favoured, enclosed on all except the sheltered side. A frequent fault is bad positioning of doors and gates; if possible these should be concentrated at the sheltered end of the building to avoid creating through draughts. Openings to eaves over well-positioned gates will provide adequate ventilation without draughts, and there will be little condensation if ventilated ridging is used.

If yards are narrow, the whole bedded area gets trodden and more straw is needed. Widths of 30–35 ft are about right, with an area of, say, 75 sq. ft per cow and calf, of which roughly 6 sq. ft is used as a calf creep. Where cows are self-fed on silage the yard area can be reduced to 50–60 sq. ft because of the additional space around the silage face.

Bracken, the traditional bedding in hill areas, is being used less because it is costly to gather, and straw for bedding has to be purchased. Less straw is used if the bedded area has a stone rather than concrete floor. Provided the stone is laid with reasonable care and well blinded with stone dust, yards can be mechanically cleaned out without difficulty. A 5ft-wide concrete strip, raised 15 inches above yard bottom along the manger front, helps to reduce treading and needs little cleaning, as the dung falls behind it when cows are feeding. Water troughs should be placed away from the bedded area. If the eaves height of the yards is 9–10 ft the need to clean out the yards in mid-winter is avoided.

Feeding arrangements need careful planning to ensure that all stock get an adequate ration and to economize in labour. Where silage is self-fed, a width of 9 inches per cow is necessary and the compacted silage height should not be over 6 ft. For dry fodder, a manger length of 2 ft per cow is required. The traditional concrete manger with hayrack over is expensive, often wasteful of fodder, and not suitable for all ages of stock. Mangers with racks which can be raised or lowered, or portable mangers, are more satisfactory. Floor level feeding is satisfactory where there is a concrete apron in front of the manger, provided the manger barrier is designed so that calves cannot get through it.

Finally, but most important, the details of the calf creep should be decided. The whole system depends upon calves having access to top quality hay and concentrates in a warm, snug area where they can lie quietly, with about 1 ft of manger per calf. The creep should be sited in the warmest part of the building away from main doors and draughts. A low, well-insulated roof will help to achieve these conditions. It is an advantage if the creep is movable, as it makes mechanical cleaning out of the yard easier.

IN BRIEF

Fertilizers: Compounds or Straights?

This question was examined by Dr. G. W. COOKE of Rothamsted, at the National Association of Contractors' Conference last month.

'These two forms should not be regarded as competitors', he said, 'but as being complementary when used for appropriate purposes. Decisions as to which to use should be based on cost per unit of plant foods applied to the land in relation to the purpose of the fertilizer. Using a limited range of compounds, or even a single compound, helps labour management. But casual choice of the fertilizers to be used, perhaps influenced more by success in bargaining than by technical questions, can only lead to waste, and perhaps to smaller yields. It is essential both to examine proposals for individual crops and to see whether manuring for the rotation as a whole is correct.

'Supplying more nitrogen than is needed at best wastes money; it is also likely to lessen yields of sugar beef, potatoes and cereals. Supplying more phosphate than is taken up by the crop is inevitable with present recommendations; the reserves of phosphate built up in the soil are useful to future crops and should be allowed for in planning fresh dressings. Crops differ in the use they make of phosphate residues; cereals and beet make much use of them, but potatoes need fresh phosphate—even when the soil has good reserves. It is easy to deplete soil potassium reserves by using 'high nitrogen' fertilizers in cash cropping and intensive grassland systems, and potash manuring must be balanced to the needs of the crops grown and to the way they are used. Uncritical acceptance of so-called "optimum" dressings can involve losses of yield that would be avoided if farmers adjusted manuring to fit their soil type and farming system.

'For efficient manuring in ordinary farming systems, two or three NPK compounds should be quite enough; one may often suffice if straight N is correctly used as well and balancing dressings of phosphate and potash are occasionally applied by a contractor or farm labour in slack periods.

Bulk blending

'Before granulated compound fertilizers were so universally made and used, farmers bought the straights they needed as powders and mixed them, or the merchants did the mixing. Because of the work involved and the bad condition of the home-made mixtures, this method of providing a compound fertilizer is now rarely used. A similar way of mixing, but with granulated nitrogen and phosphate "straights" and with muriate of potash in large crystals, has been much used recently in the U.S.A. and has been called "bulk blending". It has the obvious advantage that an advisory recommendation for a particular piece of land can be put into effect with granulated fertilizer, even when no single standard granulated compound

fits the recommendation. A serious disadvantage is the risk that the materials mixed will segregate during bagging, transport, or application, because the granules and crystals used are not of the same size and shape. There may also be difficulties in sampling and checking such mixtures to ensure that the farmer gets what he has paid for. This process has not been used on a large scale in Britain because suitable granulated forms of potash have not been available. Whether the difficulties of suitable supplies of straights or compounds for mixing, and of mixing thoroughly so that the ingredients do not segregate, can be overcome, is uncertain. Until these questions are resolved, it is difficult to decide whether bulk blending may be important in future in Britain'.

Recommended Common Names for Pesticides

Many new pesticides have been and continue to be developed and marketed at home and overseas. In general, the full chemical names of these compounds are too long and complicated for common use, and a variety of shortened forms have been used. Often, more than one short form has been used for the same compound, resulting in much confusion.

Since 1949 a technical committee of the British Standards Institution has met regularly to consider names for new pesticides, and it was as a result of this work that B.S. 1831 *Recommended common names for pesticides* first appeared in 1952. The standard was revised in 1957 and 1961, and a further revision has now been published.

This new publication lists more than 150 shortened non-proprietary names, recommended for the easy identification of pesticides with long chemical names. In addition to those names given in the 1961 edition of the standard and its supplement, all new names announced in *BSI News* (the monthly journal of the Institution) since then are now included in B.S. 1831, with additional information about these products.

The standard lists the full chemical name and structural formula of each compound, together with other non-proprietary names that have been used. The class of compound—acaricide, bactericide, fungicide, herbicide, insecticide, nematicide, rodenticide—is indicated.

To prevent, as far as possible, approved common names being used as trade names in the United Kingdom, the common names are recorded, although not registered, by the Trade Marks Registry in London.

The standard provides information on the procedure followed in agreeing common names for pesticides—both nationally, and within the International Organization for Standardization. A full index is given, together with a list of pesticides which do not require common names. In the revision, inorganic compounds have been excluded.

Further approved common names will be listed in special announcements in *BSI News* as addenda to B.S. 1831. This avoids the delay involved in preparing collective supplements to the standard.

Copies of B.S. 1831 may be obtained from the B.S.I. Sales Branch, 2 Park Street, London, W.1, price 25*s*. each (postage extra to non-subscribers).

Top Fruit Propagation: Pooling by Long Ashton and East Malling

Joint discussions between Long Ashton Research Station and East Malling Research Station have led to agreement to pool their top fruit selections. The result is that from autumn 1966 both stations will distribute the same selections of all important fruit tree varieties. They will be identified by the index letters EMLA followed by a reference number.

Progress has been such that the 'source' situation has now become complex. Some 'best available' sources, especially of apple varieties, are at Long Ashton, and others, of apples, pears, plums and cherries, at East Malling: desirable overlap of effort could not be allowed either to slow down research on the one hand or cause avoidable confusion to propagators on the other.

The material from Long Ashton and from East Malling, whether in the form of budwood or Mother trees, will be the best available as regards both pomological characters and health status. Some clones, those of which only virus-infected material could be found, have been propagated from heat-treated plants. Heat treatment of some varieties was unnecessary because no virus infection could be detected in them; this applies particularly to scions obtained from the original seedling and to stone fruits.

The total recloning of selected apple rootstocks at East Malling for freedom from all known viruses, last carried out in the 1950s, will, it is hoped, be completed for the second time, and in the light of subsequent advances in virology, by the late sixties. Rootstocks free of detectable virus for pears, plums and cherries are already widely available.

This timely joint action should ensure that nurserymen and growers can in future obtain even more readily the very best material that the research of the sister stations can produce.

Crossbreeding Pigs

Crossbred pigs have the commercial reputation of being more adaptable to tough conditions than purebreds, and this is a notion which is also common in scientific circles, although expressed in more sophisticated terms.

Very few experiments have been done in this country on the crossbreeding of pigs, though over half our litters are crossbred, and of these two-thirds are from crossbred sows. Some assessment of the merits of crossbreeding has, however, recently been made by J. W. B. King in the Report of the A.B.R.O., from data provided by PIDA's litter recording schemes.

Average performance figures of 34,000 litters, representing mainly crosses between the Large White, Landrace and Wessex Saddleback breeds, were expressed in terms of the percentage superiority in performance over that of purebred animals. On this basis it is found that when purebred sows are crossed to boars of a second breed, 2 per cent more pigs are born alive and they survive and grow better in the period between birth and weaning, compared with purebred litters. When crossbred sows are used in place of purebred sows, 5 per cent more pigs are born alive and 7 per cent more survive to three weeks of age.

The percentage superiority in performance figures over purebred, for crossbred litters and crossbred sows respectively were: litter size at birth, 2 and 5 per cent; litter size at three weeks, 4 and 7 per cent; litter weight at weaning 10 and 11 per cent. The performance figures for crossbred sows are less than those reported from the U.S.A., but this may be partly due to our habit of backcrossing with one of the parental breeds. In America the tendency to use a boar of a third breed may give better results.

Crossbred pigs usually grow a little faster after weaning than the average of their purebred parents, but the difference appears to be small. In two experiments carried out by the N.A.A.S. the advantage in growth rate for Large White x Essex crosses was 5 per cent, and for Large White x Welsh crosses, 2 per cent. In the same experiments the gain in efficiency of food conversion was only 3 and 1 per cent, respectively. Crossbreeding appears to have little effect on carcass character, the crosses generally being intermediate between the parents in this respect.

The main advantages of crossbreeding seem to lie in increased litter size, particularly when crossbred sows are used, and in some improvement in growth rate and food conversion. The main disadvantage is that two or three breeds have to be used, and if any are of inferior carcass quality they do not reach the standard

of the best purebred carcasses. This may account for the unchallenged reign of the purebred Landrace in Denmark, where the crossbred bacon pig is as rare as is the purebred porker in the U.S.A.

More experimental work is needed to determine the best combination of breeds, including foreign breeds, for a particular purpose. The merits of crossbred boars should be investigated also.

The Report is obtainable from H.M. Stationery Office or through a bookseller, price 6*s*. 6*d*.

A. J. L. LAWRENCE

Quote

Thoughts on Materials Handling

'I don't think we invest enough in an operation which occupies the majority of farming time. If not well performed it can delay sowing, planting and harvesting operations and can lead to partial or complete loss of crops and materials. To improve the handling of materials in unit loads, the Materials Handling Section of the N.I.A.E. devised a self-loading vehicle which, unlike a tractor, is basically a load-carrying vehicle having a fork-lift device at one end. It is capable of loading on to itself a number of unit loads, transporting them at quite reasonable speeds and then unloading and stacking the units.

'The machine makes this sort of materials handling a one-man, one-machine operation. Its method of loading cuts out the manoeuvring necessary when loading trailers with unit loads in the normal way, since the self-loading vehicle is driven straight up to a unit load, picks it up and continues forward to the next. This is a particular advantage in an orchard where space is limited. Work with experimental machines has shown that the method provides a high rate of work and a family of different types is envisaged for different purposes.

'Assuming the machine was required primarily for one particular crop (e.g., potatoes), it would then be desirable to use it for as wide a range of materials handling as possible, even where existing methods are reasonably effective. However, apart from handling all the materials which can be moved in the form of unit loads, the vehicle would also be suitable for other operations such as carrying a seed drill and fertilizer distributor or a muck spreader body. The vehicle could load on to itself equipment such as this and its wheel equipment would result in less ground compaction than normally occurs.

'The object in materials handling is to eliminate the movement of materials as far as possible and to mechanize what remains. But it is important that handling is seen as part of the complete system and that other machinery and operations are designed to suit mechanical handling. The potato harvester is a machine which could well be re-designed to suit unit load handling. From a handling point of view it is wrong to have a vehicle running alongside a harvester all the time it is working. A harvester designed to carry a box of suitable size which it filled and then placed on the ground out of the way of the machine in following bouts would have many advantages.

'The tractor, itself weighing about 6,000 lb, is not really suitable for load carrying. We use it for many purposes, but it is really designed for pulling, and from the materials handling point of view it can provide only drawbar pull and a small hydraulic horse-power. The tractor and trailer is a rather poor development of the horse and cart. A good horse will follow the required line without constant guidance and will stop and start on verbal command. While further technological developments are certainly possible as regards automatic guidance of tractors, these might be, from the materials handling point of view, akin to fitting a wheelbarrow with an engine for bulk handling grain!'

***JOHN HOLT**, speaking at the National Power Farming Conference, last month.*

Books

General Parasitology. V. A. DOGIEL. Oliver and Boyd. £5 5*s*.

Here we have a fascinating and attractively produced new edition of the late Professor Dogiel's book which has been brought up to date and enlarged by Y. I. Polyanski and E. M. Kheisin.

It is a not a text-book of medical or veterinary parasitology and it does not include the diagnosis, pathology symptoms and treatment of parasitic infections of man or domesticated animals. Its scope is much wider, and it shows clearly how narrow the fields of medical and veterinary parasitology are in comparison with the great variety of species of parasitic animals with which it deals. Biologists, and especially Ecologists, will be interested in the wealth of information given about the biological and ecological relationships between parasitic animals and their environments. Once the parasitic animal has established itself inside the body of a host, its environment is the body of that host. But, as Part 3 shows, it is also influenced by the host's own environment; its age, food, mode of life and by the season of the year. Also, so far as making contact with the host is concerned, by the weather.

Part 1 of the book is devoted to the definition of the various kinds of parasitism, and the difficulty of exactly defining parasitism is well brought out. Part 2 discusses the parasite's adaptations in structure, reproduction and life cycles, and in Part 4 host-parasite relationships and the problem of species in parasites are discussed.

Outstanding are Dr. Kabata's translation of the Russian text into clear and attractive English and the extensive bibliography of the fine work of Russian parasitologists. Another feature is the book's revelation of the amazing variety of modes of parasitism. The biochemistry and physiology of parasitic animals are only lightly considered. Biologists will be interested in the author's views on the origin of the various kinds of parasitism. The 228 black-and-white illustrations are clearly reproduced and the whole work is a good example of the publisher's high standard of production.

G.L.

Animal Nutrition. CYRIL TYLER. Chapman and Hall. 28*s*.

At the end of World War II there was a dearth of text-books on animal nutrition suitable for agricultural students who were, therefore, heavily dependent on their lecture notes. In 1950 Professor Tyler, with his many years of teaching experience, produced a modest-sized book, surveying the subject generally, but with decided emphasis on animal nutrition as a branch of biochemistry and physiology. Now, some fourteen years later, he has written a second edition, and although the original pattern and emphasis have been retained, chapters on soils and monetary values of feedingstuffs have been omitted, as well as the appendices of detailed biochemical cycles. Other chapters have been extensively revised in the light of recent advances in knowledge.

The book, by implication, is intended to be complementary to a course of instruction, since it also includes a recommended list of books and journals to which the reader is referred to obtain a fuller explanation of each facet of the subject. It is divided into seven main sections, The Food of Animals; Digestion, Absorption, Transport and Storage of Food Constituents; Their Utilization; Excretion; Experimental Techniques; Maintenance and Production, and Nutritive Values and Scientific Rationing. Between two and seven short chapters are devoted to each section.

The treatment is variable in respect of detail. Biochemical cycles such as the tricarboxylic and the ornithine are given in bare outline, with little or no supplementary explanations, and a more detailed knowledge of organic chemistry and biochemistry than is likely to be possessed by the average student reader is pre-supposed. Thus, the book is primarily directed at the type of student who is fortunate enough to enjoy a pattern of instruction such as the author gives to his own classes.

The appeal of this book must be much greater to the degree student than to the nutritional adviser, the practical farmer or to those engaged in the feedingstuffs trade. Even to such a student, its value must depend largely on the extent to which his teachers are prepared to adjust their courses to the plan of the book and to expand their teaching to cover what has necessarily to be omitted from a work of such modest size.

Nevertheless, the material has been presented with commendable clarity, which could only come from an author well versed in the subject, and with a long experience of teaching it. Indeed, it may not be out of

place to suggest that Professor Tyler might consider using his experience, knowledge and undoubted gift of clarity of expression to expand his text in order to produce a comprehensive treatise on animal nutrition that would embody much of the material he now invites his readers to seek from other sources.

A.E.

The Scientific Principles of Crop Protection (5th Edition). H. MARTIN. Edward Arnold. 90*s*.

This excellent book needs no introduction to English chemists. In fact, from 1928 onwards most of us have cut our crop protection teeth on it. Dr. Hubert Martin is to be congratulated on his selection of additional material and the publishers on producing a book of excellent clarity. The numerous formulae which illustrate it are particularly well set out; in this respect it is a marked advance on all previous editions.

To those unfamiliar with the book, I have always wondered whether the title is misleading, although superficially pleasing. Thus the inclusion of the word 'scientific' perhaps suggests that the author has in store for us another book on the non-scientific principles. More probably, however, it is intended to exclude such agricultural practices as ploughing, or Chinese inventions such as catching sparrows by hand.

The sixteen chapters review the highlights of the literature and ably comment upon them, special attention being paid to the mode of action of the pesticides and any exotically pleasing methods of control. No attempt is made, however, to drag principles out of this welter of discovery and fact. Indeed this may not be possible: it would be a bold man who attempted it.

Three chapters deal with methods of control, other than those given by chemicals, and there is another on formulation which is of historical interest. Although fifty-two pages are taken up in describing the obsolescent inorganic and naturally occurring insecticides, only sixteen are spared for weed-killers. A chapter on synthetic contact insecticides occupies forty-one pages and includes systemic chemicals. In addition, there are sections on fumigants, seed and soil treatment, and traps of all types ranging from rodenticides to sex attractants. Chemosterilants are mentioned for the first time.

This book is free of obvious errors and can be highly recommended to the chemist, the biologist, the student and those concerned with the hazards of crop protection chemicals to birds and man. Anyone who already possesses the fourth edition might be well advised to start saving up for the sixth.

R.deB.A.

Practical Poultry Keeping (6th Edition). *Poultry World.* Revised by J. PORTSMOUTH Iliffe Books. 21*s*.

Practical poultry keeping today involves everything from the backyard poultry keeper to the planned empires of J. B. Eastwood and others. A book which appears with this title might be expected to cover all aspects, and to attempt to do this in so small a compass is to invite failure, relative or total. It is to the credit of all concerned that failure is not total.

Within the narrow confines of some 160 pages all aspects of poultry keeping, including turkeys, ducks and geese, are touched upon, but it must be fairly stated that the book would not be of much help to a beginner in the field or of practical value to an established poultry keeper. It does serve as a compact summary of the salient points of the poultry enterprise of today hinting at, but not helping to solve, the difficulties that can so often and so easily arise.

It is a pity that 25 pages were devoted to diseases and parasites. This is a vast field of specialized knowledge which is constantly subject to revision as new organisms emerge and require identification and study before treatment can be laid down. This chapter would be of little value to a poultry keeper with a single sick bird or with a flock problem; and this space could have been utilized more effectively in expanding some of the sections on management.

Few errors of fact have come to light. But it is not true to say (page 23) that the temperature of the broody hen is normal. Baldwin and Kendleigh in 1932 showed that the temperature of the broody hen is about 2 deg. F lower than that of a non-broody hen. Nor is it correct to say (page 121) that eggshell thickness decreases with age. It is true that shells tend to be thinner towards the end of the laying season, but after a moult, natural or forced, and resumption of laying, shell thickness returns to normal.

The text is clear and easy, even on old eyes. The illustrations are good and well chosen.

W.M.A.

Portrait of the Quantocks. VINCENT WAITE. Robert Hale. 21*s*.

Mr. Vincent Waite's 'portrait' provides us with yet another look on the Green Hills of Somerset; it is one of the best yet written.

To those who know and love the Quantocks, the pages unfold new and fascinating stories, while to others who have yet to discover the beauty and charm of the hills, the combes and small villages tucked away from the turmoil and pace of everyday life, the book offers an invaluable guide, whether it be to the student or to those who explore for pleasure.

The account on geology by Mr. A. W. Coysh enhances its value to the student; as does the chapter on Natural History by Dr. Ernest Neal of Taunton School. His account on the habits of the badger family and the red deer are particularly interesting. But it is the history of the Quantocks, descriptions of the inhabitants, and the selected quotations which make this book so enjoyable.

One discovers that some of the earliest experiments in electricity were carried out by a Mr. Andrew Cross of Broomfield, who records that while at school he was caned three times daily for seven years. Such punishment might have been expected to warp his nature, but his epitaph reads 'He was humble towards God and kind to his fellow creatures'. A salutary thought for this modern age.

A most remarkable example of the continuity of land tenure is provided by the Manor House, East Quantoxhead, having been in the same family since 1207—the present owner is, through only two females, the lineal descendant of the original owner after the Conquest.

Cider and cheese are closely associated with Somerset, and cider is still a favourite drink. This book records that during the late nineteenth century the local 'beveridge' had become so much a part of the labourer's diet that one-fifth of his scanty pay was in rough cider, with disastrous effect on his household.

Many famous people have either lived or had association with the Quantocks—the legendary King Arthur, King Alfred, the famous John Wesley, the poets Wordsworth, Coleridge and Sir Henry Newbolt, and it was these hills that inspired some of Coleridge's best poetry, including the Rime of the Ancient Mariner, and Kubla Khan.

There are stories of the notorious Judge Jefferies, smuggling on the Quantock seaboard, and a story of a tax collector appointed by Henry VII, to whom resistance spread throughout the West Country: and he fled to Taunton where the insurgents 'slewe hym pytuously in such wise that he was dismembered and kutte in many and sundry peces'.

Altogether a very readable book which I strongly commend.

K.W.S.

The Daffodil and Tulip Year Book, 1965. Royal Horticultural Society. 15*s*.

In his introduction to this volume, the new Chairman of the Narcissus and Tulip Committee of the R.H.S. thanks the 'giants of the daffodil world' for welcoming him into their inner sanctum and sharing their knowledge. Readers will enjoy a similar experience and feel that they have been admitted to a charmed circle where the show daffodil reigns supreme. They are conducted round the breeding grounds of some of the leading raisers and listen to discussions on the merits of the newest varieties and their performance on the show benches of the world. This international flavour, of both text and illustrations, is a feature of this Year Book.

Comparison with earlier issues emphasizes again the ever-widening gap between the daffodil fancier and the commercial grower, who now receives short shrift from the 'giants'. A contribution from Rosewarne Experimental Horticulture Station, if it does not bridge the gulf, at least explains growers' needs and presents a well-considered analysis of the essential characteristics of market daffodils. Similar problems in the tulip trade are mentioned by Dirk Lefeber in his article, which deals primarily with his Darwin (Darwin × *fosteriana*) and other interspecific tulip hybrids. A report of the Wakefield Tulip Show reveals that the old English florists' tulips are still exhibited there, tulips which were brought to near extinction by over-concentration on the show-bench.

Botanical interests are catered for by notes on some lesser-known species of tulips and of narcissus in Andalusia. The customary brief attention to an allied bulbous plant is accorded this year to Nerines, the account of the Exbury hybrids being particularly interesting.

Thus far the established pattern of providing new information on many diverse aspects of daffodils and tulips is followed. It is the more disappointing that no scientific contribution is included

this year—unless this term can be applied to the entertaining description of the digital computer being used by the American Daffodil Society. As usual, the quality of the illustrations is excellent, especially of the colour plates.

K.H.J.

Biology as a Career. Institute of Biology. 3*s.* 6*d.*

Farmers have, amongst many other things, to possess something of the biologist in their make-up. The care of livestock, the details of crop varieties and the awareness of diseases and pests all come to them at some time or other. Then, again, the need to identify weeds will make minor naturalists of arable farmers. Farmers are also aware of the professional biologist in the veterinary scientist, mycologist, entomologist and plant protectionists, as well as the crop and animal husbandry advisers who play so prominent a part in his business life. The geneticist, too, will find a ready audience in this, one of his most applied fields.

It is not surprising, therefore, that the farming community has long been a fertile source of biologists; where information is required, by parents and their children, on this profession this booklet will be invaluable. It includes sections on training and opportunities (including agriculture, horticulture and forestry) and on the demands for, and rates of pay of biologists. There is also a useful list of University Departments which offer honours degree courses in biological subjects.

The booklet may be obtained through booksellers or from the Institute of Biology, 41 Queen's Gate, London, S.W.7.

D.M.B.

Commuters' Village. RUTH CRICHTON. David and Charles. (Distributed by Macdonald and Co.) 21*s.*

With the decay of local craftsmanship and the building of by-pass roads, the whole character of many English villages has changed—sometimes for the better and sometimes for the worse. Many villages have, in effect, become dormitories for commuters. One of these is Stratfield Mortimer in Berkshire, and it is indeed fortunate that Ruth Crichton has made it her business to carry out an intensive study of the contemporary scene in this interesting spot.

Over the years the influence of patronage has been less marked and the parish council has become a real force in the land. The term 'community leader' or 'leader of community thought', so popular across the Atlantic, is just as important in the heart of the Royal County. There have always been community leaders and this survey has certainly shown where they are.

A questionnaire completed by the people of Stratfield Mortimer provided information about many aspects of their village life, including the nature of their occupations, the degree of social integration and their attitude towards local government and village cliques. The unrest of modern society has created problems, even in this little English paradise. The village children have their own ideas on how these problems should be dealt with; they would prefer that more time should be spent on the open spaces. The children oppose the building of café bars and cinemas because, as one said, 'that is where the teddy-boys meet and start fighting, and gives Stratfield Mortimer a bad reputation'.

This high regard for the reputation of the community is one of the forces which holds a small village together. Readers of this book may be tempted to conduct their own survey of other communities with which they personally may be more familiar, but in any event they will certainly appreciate the pioneer work done by Ruth Crichton.

J.W.

United Kingdom Dairy Facts and Figures, 1964. The Federation of United Kingdom Milk Marketing Boards.

Here again we have a most useful report, published by the five Milk Marketing Boards in the United Kingdom, which gives a wealth of information on almost every aspect of the British Dairy industry.

It is interesting to note that whilst the number of registered milk producers in the British Isles has dropped since before the war, there is a large increase of milk producers in Northern Ireland.

The average number of cows per herd is twenty-three but Northern Ireland, with eleven cows a herd, has a predominance of small units. Contrary to recent trends, the average yield per dairy cow for the United Kingdom fell in 1963-64 by fourteen gallons to 765 gallons. Unfavourable weather conditions contributed to this setback.

Total sales of milk from farms in 1963-64 fell by 80 million gallons below the previous year. The British Isles and Northern Ireland contributed to the decline, although it was more prominent in England and Wales. Liquid milk consumption, however, rose considerably and milk production for fresh cream increased, but there was a decrease in the amount available for use in milk products such as butter and cheese.

While completely self-sufficient in fresh and condensed milk, and to a large degree in fresh cream, it is interesting to know that the United Kingdom imported over one-third of its dried milk, half of the tinned cream and just over half of the cheese and almost all of the butter (over 90 per cent).

The average housewife spends on milk about one-tenth of her total outlay on food and thus purchases for her family one-tenth of the energy value, nearly one-fifth of the protein and nearly half of the calcium that her family eats.

Copies of this report may be obtained from the Milk Marketing Board, Thames Ditton, Surrey, price 7*s*. 6*d*. for one to four copies, 6*s*. each for orders of five or more (incl. postage).

Index of Agricultural Research, 1964 (4th Edition). AGRICULTURAL RESEARCH COUNCIL. H.M. Stationery Office. 12*s*. 6*d*.

This new edition highlighting the research projects of the Agricultural Research Council is of the greatest value to all concerned with the scientific advance of farming and market growing.

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Together with its companion volume *The Agricultural Research Service*, the Index provides information about all scientific research for which the A.R.C. has responsibility.

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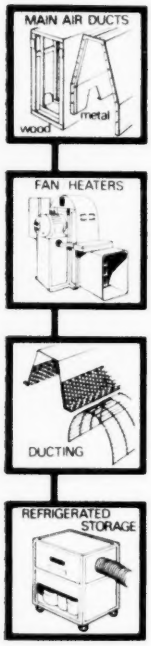

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Required, with an assisting staff, to design, organise and take charge of a new Sugar Cane Breeding Division, which is expected to consist of a central station and several associated sub-stations.

Candidates should hold a degree in botany or agricultural botany with several years' experience in sugar cane research, preferably in breeding.

Salary Scale either P.S.O. £2,177 to £2,808 a year or S.P.S.O. £3,125 a year plus 25% terminal gratuity. A 12½% increase in salaries has been approved. Passages provided. Quarters available. Education allowances. Generous leave. Contract appointment for two tours of two years.

Candidates, who should be nationals of the United Kingdom or the Republic of Ireland, should apply for further details, giving full name, and brief particulars of qualifications and experience, quoting RC 213/214/015 to:

Appointments Officer,
Room 301,
Ministry of Overseas Development,
Eland House, Stag Place,
London S.W.1.

AGRICULTURAL OFFICERS

WEST CAMEROON

Required to supervise and plan extension services, to investigate and plan the improvement of cash crops and to train junior staff.

Candidates must hold either (*a*) a degree in agriculture or horticulture plus two years post-graduate training followed by three years experience, or (*b*) a degree in agriculture or horticulture plus at least five years experience, two of which must be in the tropics.

Salary £2,052 a year plus a gratuity of £37 10*s*. for each three months service. Passages provided. Quarters available. 15-24 months contract. Generous leave.

Please apply for further details, giving full name and brief particulars of qualifications and experience, quoting RC 213/33/02 to:

Appointments Officer, Room 301,
Ministry of Overseas Development,
Eland House, Stag Place,
London, S.W.1.

AGRONOMIST

WEST CAMEROON

Required to conduct experiments on food crops and to train junior staff.

Candidates must hold a degree in agriculture plus two years post-graduate training in agronomy, followed by at least three years field experience, in carrying out statistical experiments with field crops.

Salary £2,052 a year plus a gratuity of £37 10*s*. for each three months service. Passages provided. Quarters available. 15-24 month contract. Generous leave.

Please apply for further details, giving full name and brief particulars of qualifications and experience, quoting RC 213/33/05 to:

Appointments Officer,
Room 301,
Ministry of Overseas Development,
Eland House,
Stag Place,
London, S.W.1.

OFFICIAL APPOINTMENTS

PASTURE RESEARCH OFFICER
WEST CAMEROON

Required to investigate pastures, particularly in Bamenda highlands and to devise means by which these pastures can be improved and stock carrying capacity increased.

Candidates must hold an honours degree in botany, preferably agricultural botany, plus two years post graduate training in pastures followed by three years field experience.

Salary £2,052 a year, plus a gratuity of £37 10*s*. for each three months service. Passages provided. Quarters available. 15-24 month contract. Generous leave.

Please apply for further details giving full name, and brief particulars of qualifications and experience, quoting RC 213/33/03 to:

Appointments Officer,
Room 301,
Ministry of Overseas Development,
Eland House, Stag Place,
London, S.W.1.

AGRICULTURAL ECONOMIST
WEST CAMEROON

Required to organise and run the Agro-Statistical Sections of the Department of Agriculture and to train junior staff in the collection, analysis and interpretation of Agro-Statistical data.

Candidates must hold an honours degree in economics, agricultural economics or agriculture, followed by a two years post-graduate course in agricultural economics.

Salary £2,052 a year plus a gratuity of £37 10*s*. for each three months service. Passages provided. Quarters available. 15-24 month contract. Generous leave.

Please apply for further details, giving full name and brief particulars of qualifications and experience quoting RC 213/33/04 to:

Appointments Officer,
Room 301,
Ministry of Overseas Development,
Eland House, Stag Place,
London, S.W.1.

AGRONOMIST
UGANDA

Required to investigate the selection of grasses and legumes and their development in mixtures suitable for Uganda conditions and the effect of leys on soil fertility and the use of subsequent crops.

Candidates should possess an Honours degree in Agriculture or Botany. Post-graduate training or experience in Pasture Agronomy for at least 2 years would be an advantage.

Appointment on contract for one or two tours of 21-27 months. Salary (inclusive) £1,221—£2,448 a year plus terminal gratuity of 25%. An increase of 12½% of gross salary has been approved. Education Allowances. Passages provided. Generous leave.

Applicants should be Nationals of the United Kingdom or the Republic of Ireland and should send their full name and brief particulars of their qualifications and experience, quoting RC 213/183/06 to:

Appointments Officer, Room 301,
Ministry of Overseas Development,
Eland House, Stag Place,
London, S.W.1.

AGRICULTURAL OFFICERS
TANZANIA
(TANGANYIKA AND ZANZIBAR)

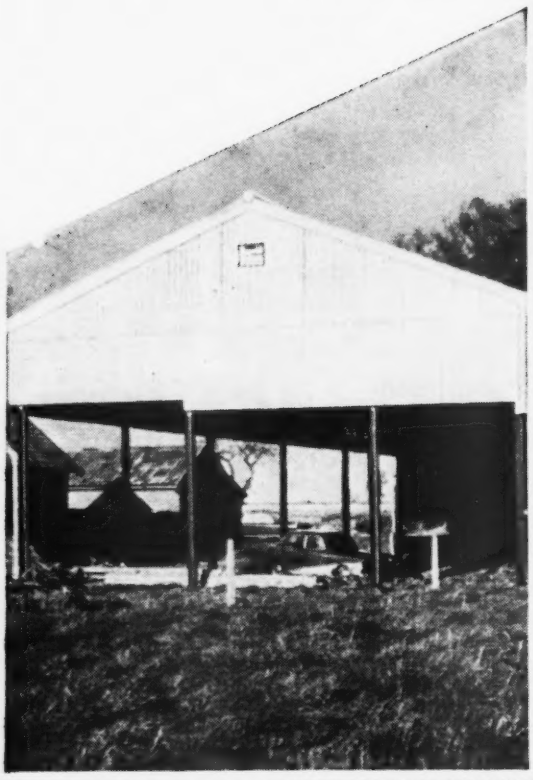
Required for supervision of extension activities with emphasis on livestock; investigational work to improve grassland management, livestock products and the use of draught animals, to train local staff and farmers and experimental work on agricultural stations.

Candidates must hold a degree in agriculture.

Salary scale £1,179—£2,448 a year plus 25% terminal gratuity. An increase of 12½% of existing gross salaries has been approved. Passages provided. Education allowances. 21 to 27 month contract. Generous leave.

Candidates, who should be nationals of the United Kingdom or the Republic of Ireland, should apply for further details giving full name and brief particulars of qualifications and experience, quoting RC 213/173/01 to:

Appointments Officer, Room 301,
Ministry of Overseas Development,
Eland House, Stag Place,
London, S.W.1.



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